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OHIO RIVER POLLUTION SURVEY BEAVER RIVER BASIN, VOLUME II

PUBLIC HEALTH SERVICE
CINCINNATI, OHIO

1942

PB 260 110

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The Beaver River Basin is studied as part of the Ohio River pollution survey. The streams and reservoirs of the basin are intensively used as sources of municipal and industrial water supplies and for recreation. Except for the Beaver and section of the Mahoning and Shenengo Rivers, the streams of the basin are relatively clean. Reservoir sites have been investigated with a view toward providing needed additional flow for both pollution abatement and industrial water supply. Eighteen of the 50 public water supplies in the basin are from surface sources. Primary treatment is indicated at four other communities where stream flows are adequate. Improvements are needed at eight facilities. Industrial treatment is needed primarily to reduce phenol discharges and the acid load on the stream.

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U. S. PUBLIC HEALTH SERVICE
CINCINNATI, OHIO
1942

BEAVER RIVER BASIN

From Volume II (of three volumes) of
Final Report to the Ohio River Committee
Ohio River Pollution Survey

Prepared at the request of the War Department
by the U. S. Public Health Service in cooperation
with the Corps of Engineers, U. S. Army.

INTRODUCTION TO DRAINAGE BASIN SUMMARIES

The basic information of the Ohio River Pollution Survey has been presented in summaries covering the main Ohio River, minor tributary basins and the nineteen major tributary basins. An effort has been made to have each summary complete in itself. Certain explanations, applicable to each, have been made in this section to avoid repetition.

Insofar as possible, information for each basin is preseted in as near identical form as possible, according to the following general outline:

Syllabus and Conclusions
Description
Presentation of Field Data
Presentation of Laboratory Data
Hydrometric Data
Discussion

Accompanying the text are a number of tables, maps and charts. With the exception of the division on the main Ohio River, similarly numbered tables and figures cover similar material in each basin summary.

In the tabulations of costs (Table 1) the annual charges are based on interest rates of 3½% for municipal and 5% for industrial construction and periods for amortizations of 40 years for interceptors, 20 years for municipal treatment plants and 10 years or less for industrial corrective measures. Studies of interest rates and life of treatment facilities have indicated that these figures represent about the average experience of municipalities and industries. Cost estimates of individual projects are not shown except in a few cases where they are based on engineering surveys. Since most of the estimates are not based on detailed studies of each situation they may be considerably in error in individual instances. Grouped for an entire basin, the probability of error is greatly reduced and it is believed that the figures shown are an accurate indication of the cost of the suggested pollution abatement program. Costs of providing lateral sewers or for the extension of sewers to areas now lacking them are not included in the estimates.

The urgency of the individual projects for which cost estimates have been made is far from uniform. Some projects are needed to correct critical pollution conditions while in other

cases the need and justification for the expenditure is less outstanding. The basin summaries place stress on the more critical and larger sources of pollution where effects are not confined to local areas. However, cost estimates presented apply not only to the urgent situations but to a complete program of pollution control such as might take place during the course of the next 10 to 20 years. In the special case of a stream highly acid from the effects of mine drainage, expenditure of public funds for acid reducing measures should precede or at least parallel expenditures for sewage and organic pollution abatement.

Cost estimates are based on average experience from 1928 to 1940. Costs for 1942 would be considerably higher and future costs will probably be subject to further change depending upon fluctuation in construction costs for this type of work.

Throughout the report quantities of organic industrial wastes have been expressed as "sewered population equivalent (B.O.D.)".* Extensive measurements have shown that the average oxygen demand of domestic sewage is .168 pound (5-day, 20°C.) per capita per day and this factor has been used to convert industrial waste loads to a readily understandable basis. In the tabulations of sources of pollution (Table 3), the column "Sewered Population Equivalent (B.O.D.), Untreated" represents the total of the population connected to sewers plus the population equivalent of industrial wastes discharged at each locality. The difference between this column and the adjacent column "Sewered Population Equivalent (B.O.D.), Discharged" represents the reduction in the pollution load due to treatment in a municipal treatment plant.

Where accurate laboratory results of treatment plant operation were available, these were used to determine the pollution load both before and after treatment. In the absence of such records reductions of 35% by primary treatment and 85% by secondary treatment were assumed.

No differentiation has been made in the tables, maps or charts between industrial wastes which are discharged only seasonally and those which are discharged throughout the year. The pollution loading shown represents conditions during normal operations at the height of the season. In the case of the canning industry, this may occur only during a few weeks in the year but these few weeks are often during the late

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* Biochemical Oxygen Demand (5-day 20° C.).

summer when the effects of organic pollution on the oxygen balance of the stream are most serious. On the other hand, the season for distillery operations in most cases is during the winter months when the effects of oxygen depleting pollution are less serious.

Nowhere in the report has a quantitative statement been made as to the reduction in the industrial waste pollution load due to treatment, recovery, or other measures at the industrial plant. Such a statement would necessitate a definition of the strength of untreated industrial wastes from each type of industry. This is impracticable since the strength of the wastes depends to a large degree on plant practices which vary widely. For instance, in some meat packing plants all blood, paunch manure and offal are recovered and in others these materials are discharged to the plant sewers. Wastes discharged from vegetable canneries have been found to vary by as much as 400% due to differences in "housekeeping" methods. Wastes from paper mills vary depending on the use of save-alls, recirculating systems and other pollution reduction measures. At some plants reduction in pollution is inadvertent and is brought about by the recovery of valuable by-products or prevention of waste of raw materials. At others expense is incurred which produces nothing but a reduction in pollution discharges. Tabulations of industrial wastes (Table 4) shows the number of plants that have taken steps of either kind which result in some reduction in the pollution load from the plant.

BEAVER RIVER BASIN

Final Report to the Ohio River Committee

Ohio River Pollution Survey

U. S. Public Health Service
Cincinnati, Ohio
1942

BEAVER RIVER BASIN

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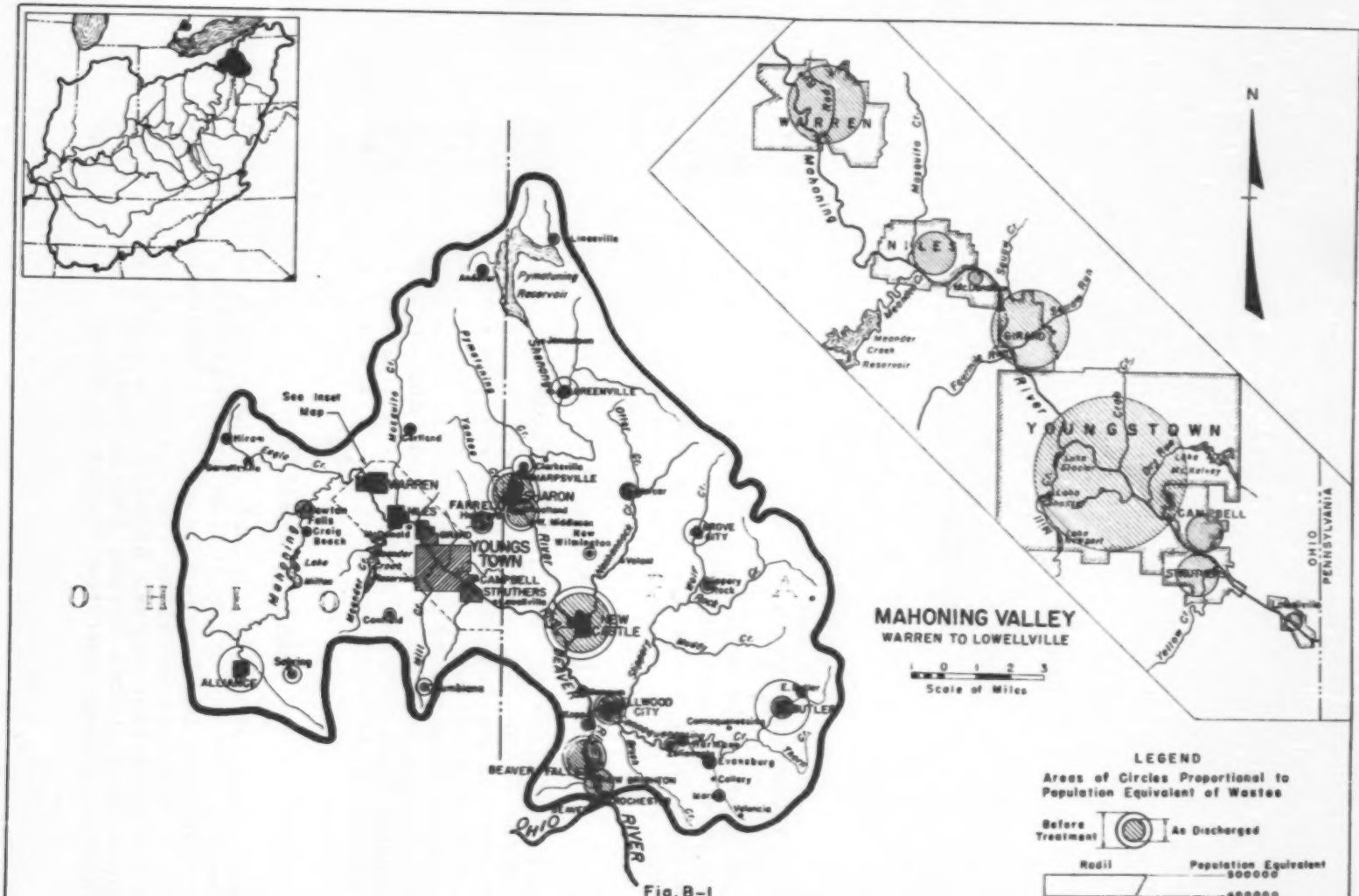

See Inset Map
OHIO
PENNSYLVANIA
WARREN
YOUNGSTOWN
NILES
CAMPBELL
STRUTHERS
GIRARD
SHARON
FARRELL
GREENVILLE
NEW CASTLE
ALLIANCE
EAST LIVERPOOL
BEAVER FALLS
ROCHESTER
Mahoning River
Shenango River
Beaver River
Ohio River
Pymatuning Reservoir
Meander Creek Reservoir
Lake Glacier
Lake McKinley
Lake Newport
Lake Milton
Lake Hamilton
Newton Falls
Craig Beach
Grove City
Ellwood City
Evansburg
Callery
Volant
Slippery Rock Creek
Conneaut Creek
Yellow Creek
Little Beaver Creek
Mosquito Creek
Pymatuning Creek
Shenango Creek
Yankee Creek
Otter Creek
Hubbard Creek
Meander Creek
Mill Creek
Crab Creek
Sandy Creek
Hickory Creek
Turkey Creek
Big Run
Little Run
Connoquenessing Creek
Slippery Rock Creek
Neshannock Creek
Hogback Ridge
Chestnut Ridge
Laurel Hill
Negley
Salem
Canfield
Lowellville
Struthers
Girard
Niles
Warren
Youngstown
Campbell
Sharon
Farrell
Greenville
New Castle
Alliance
Beaver Falls
Rochester
Ellwood City
East Liverpool
Grove City
Evansburg
Callery
Volant

BEAVER RIVER BASIN

Syllabus and Conclusions

Syllabus

The Beaver River drains 3,145 square miles in Ohio and Pennsylvania. The population of the area is 728,000, roughly 230 per square mile, of which almost two-thirds are in urban communities. The largest city, Youngstown, Ohio (167,720) is the center of the third largest steel producing area in the country. The streams and reservoirs of the basin are intensively used as sources of municipal and industrial water supply and for recreation. About 42 percent of the sewage is treated and more than 95 percent of the untreated wastes enter the Mahoning River in the Youngstown district (Warren to Lowellville). Except for the Beaver and sections of the Mahoning and Shenango Rivers, the streams of the basin are relatively clean. Abatement of pollution in the Youngstown district can be most economically effected by a combination of waste treatment and stream flow regulation. Reservoir sites have been investigated by the U. S. Engineer Department with a view toward providing needed additional flow for both pollution abatement and industrial water supply. Further industrial development in the Youhgstown district should be predicated on obtaining additional water from sources not now considered.

Conclusions

(1) Eighteen of the 50 public water supplies in the basin are from surface sources. Twelve of these, serving 430,000 people are from streams or reservoirs subject to pollution.

(2) Sewage from 515,000 people, industrial wastes equivalent to sewage from an additional 165,000 people and about 32 tons of acid per day enter the streams of the basin. Thirty-six plants treat about 42 percent of the sewage and several of the industrial plants have installed waste treatment facilities.

(3) Laboratory data show the Mahoning River, particularly in the Youngstown district, to be grossly polluted. The Beaver River is moderately polluted and the Shenango is in fairly satisfactory sanitary condition. Smaller tributary streams are relatively clean.

(4) The major pollution problem of the basin is in the Youngstown district. More than 95 percent of the untreated wastes in the entire basin enter the Mahoning River in the 25 miles from Warren to Lowellville.

(5) Industrial water use in this stretch, principally for cooling purposes, is about 20 times the minimum stream flow. The resulting high water temperatures intensity the effects of pollution and increase industrial costs.

(6) Chemical treatment of sewage plus low-flow control by reservoirs offers the most economical method of organic pollution abatement in the Youngstown district. Low-flow augmentation alone, or without a parallel program of sewage treatment, will actually have a detrimental effect on the Beaver River because of decreased time of flow. Local conditions and river temperature will, of course, be improved.

(7) Primary treatment, the minimum that can be considered satisfactory under the most favorable circumstances, is indicated at four other communities where stream flows are adequate including Newton Falls, Ohio and New Brighton, Pennsylvania. The latter city, being near the mouth, is primarily an Ohio River problem. Secondary treatment is indicated at five small towns in Ohio located on streams subject to very low flows. Additions or improvements to treatment facilities are needed at eight places and progress is being made toward completion of the improvements in most of these cases.

(8) Industrial treatment is needed principally to reduce phenol discharges at by-product coke plants and to reduce the acid load on the stream. This can be accomplished by methods now in use at other plants.

(9) A summary of cost estimates of remedial measures from Table B-1 follows:

Treatment	Capital Cost	Annual Charges
Existing	$4,760,000	$ 415,000
Suggested additional	6,000,000	865,000

Estimated additional costs, over existing charges, of programs involving uniform treatment throughout the basin are:

Primary, all places	5,830,000	845,000
Secondary, all places	10,680,000	1,265,000

Table B-1 Beaver River Basin - Estimated Cost of Existing and Suggested Minimum Corrective Measures for Sewage and Industrial Wastes, with Comparative Costs for Primary and Secondary Treatment.

	Number of Plants Prim.	Sec.	Population Connected to Sewers	Capital Investment (Dollars)	Annual Charges (Dollars) Amort. & Interest	Operation & Main.	Total
Existing Sewage Treatment	17	18	218,400	4,760,000	300,000	115,000	415,000
Suggested Minimum Correction							
Sewage Treatment Plants	14	5	297,100	2,970,000	210,000	190,000	400,000
Required Interceptors	-		-	1,990,000	95,000	-	95,000
Independent Industrial Waste Correction	-		-	1,040,000	135,000	235,000	370,000
Total				6,000,000	440,000	425,000	865,000
Comparative Cost							
Primary Treatment All Waste				5,830,000	425,000	420,000	845,000
Secondary Treatment All Waste				10,680,000	710,000	555,000	1,265,000
As Suggested				6,000,000	440,000	425,000	865,000

Description

The Beaver River is formed by the confluence of the Mahoning and Shenango Rivers near New Castle, Pennsylvania, and flows southward for 20 miles to its junction with the Ohio River 25 miles below Pittsburgh. It drains an area of 3,145 square miles, of which 1,360 are in Ohio and 1,785 in Pennsylvania. Much of the land is flat, particularly in the northern half of the basin but the southeastern portion is quite hilly. The principal tributaries of the Beaver River are:

Tributary	Distance above Mouth of Beaver	Drainage Area Square Miles
Connoquenessing Cr.	12.4	830
Mahoning River	20.7	1,100
Shenango River	20.7	1,080

The basin is densely populated (230 per sq.mi.) and about two-thirds of the population is in the 22 urban communities. The populations of some of the larger cities and of the basin as a whole are shown below.

Principal Cities	Population			
	1910	1920	1930	1940
Youngstown, Ohio	79,066	132,358	169,912	167,720
New Castle, Pa.	36,280	44,938	48,674	47,638
Warren, Ohio	11,081	27,050	41,062	42,837
Sharon, Pa.	15,270	21,747	25,908	25,622
Butler, Pa.	20,728	23,778	23,568	24,477
Alliance, Ohio	15,083	21,603	23,047	22,405
Beaver Falls, Pa.	12,191	12,802	17,147	17,098
Niles, Ohio	8,361	13,080	16,314	16,273
Farrell, Pa.	10,190	15,586	14,359	13,899
Campbell, Ohio	4,972	11,237	14,673	13,785
Ellwood City, Pa.	3,902	8,958	12,323	12,329
Struthers, Ohio	3,370	5,847	11,249	11,739
Entire Basin				
Rural	178,013	189,950	220,208	251,101
Urban	251,086	389,343	480,079	477,267
Total	429,099	589,293	700,287	728,368

Almost all of the cities experienced a period of rapid population increase during the first 30 years of this century which saw the region develop into a major center of steel production.

This period of rapid growth ended in 1930 and most of the cities lost population during the next 10 years. The rural population continued to increase however.

Water Uses - None of the streams are navigable at present except for the lower mile of the Beaver which is affected by backwater from the Ohio River. A proposal to connect the Ohio River and Lake Erie by a canal using the Beaver, Mahoning and Grand Rivers has been studied by the U. S. Engineer Department and considered by the Congress a number of times but has not been authorized.

There are no hydroelectric power storage reservoirs and no sites where the development of hydroelectric energy appears to be economically feasible at the present time. No flood-control reservoirs, as such, have been built but a number of reservoirs built for other purposes have undoubtedly aided in reducing flood heights. The largest of these are the Pymatuning Reservoir, Lake Milton and Meander Reservoir. Pymatuning Reservoir on the upper Shenango has a capacity of 192,000 acre-feet and a surface area of 17,880 acres. It was built by Pennsylvania primarily to regulate stream flow to insure an adequate supply of water for downstream cities and industries. Lake Milton on the Mahoning River above Warren was built by the city of Youngstown and private interests to increase the flow of the stream during dry weather. It has been useful in this respect but its small capacity of 28,100 acre-feet has limited its utility. Both Pymatuning Reservoir and Lake Milton are used extensively for recreation. Meander Reservoir on Meander Creek was built by the Mahoning Valley Sanitary District to provide public water supplies for Youngstown and Niles. Its capacity is 32,400 acre-feet. Fifteen other reservoirs with capacities of from 100 to 4,600 acre-feet have been built for water supply, recreation or flow regulation.

The Berlin Reservoir on the Mahoning above Lake Milton is now (1942) under construction by the U. S. Engineer Department in connection with the authorized program for Ohio River flood control. In addition to controlling floods, the reservoir will provide storage for low-flow control.

Presentation of Field Data

Figure B-1 shows the location and magnitude of the more important sources of pollution in the basin. Figure B-2 shows similar data and, in addition, the location of public water supply intakes from polluted streams and selected laboratory data on coliform organisms, dissolved oxygen and B.O.D.

Public Water Supplies - Fifty public water supplies in the basin served 554,100 people. Eighteen supplies serving almost 500,000 people are from surface sources and twelve of these are from streams or reservoirs subject to sewage pollution. Table B-2 shows data on the surface water supplies of the basin. The supplies from the Beaver River are the most seriously polluted and the most complete treatment of these supplies often fails to produce a palatable water.

Sewerage - Sewage from 515,700 people is discharged to the streams of the Beaver Basin. About 42 percent of this waste is treated. In the Pennsylvania section of the basin practically all sewage is treated, the principal exception, New Brighton, discharging only about one mile from the mouth and being primarily an Ohio River problem. On the other hand, in the Ohio section of the basin, 285,800 out of 321,500 discharge sewage without treatment. Almost all of this waste enters the Mahoning River in the 25-mile stretch from Warren to Lowellville.

There are 35 sewage treatment plants in the basin, 17 of which provide primary treatment and 18 of which provide secondary treatment. Twenty-six of the plants are in Pennsylvania and only 9 are in Ohio.

Industrial Wastes - Table B-4 summarizes data on the sources of industrial wastes by type of industry and method of disposal. The population equivalent of these wastes does not reflect the magnitude of the industrial waste problem since the steel mill wastes have no significant B.O.D. The disposal of waste pickle liquor from steel mills in the basin is summarized as follows:

Free Acid* in Waste Pickle Liquor - Pounds per Day

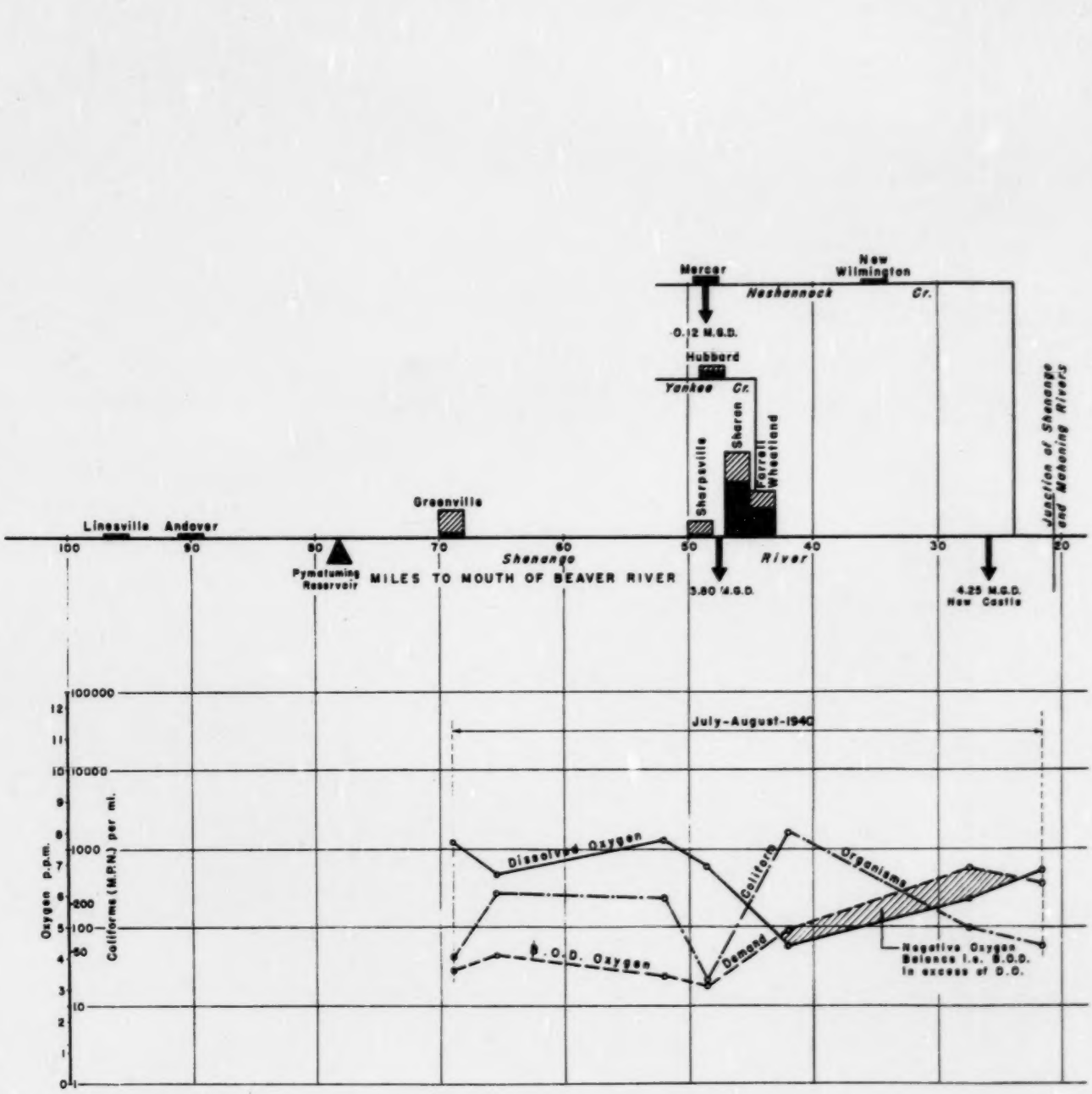
State	Total	Neutralized	Discharged Without Neutralization
Ohio	63,000	3,000	60,000
Pennsylvania	18,600	14,800	3,800
Total	81,600	17,800	63,800

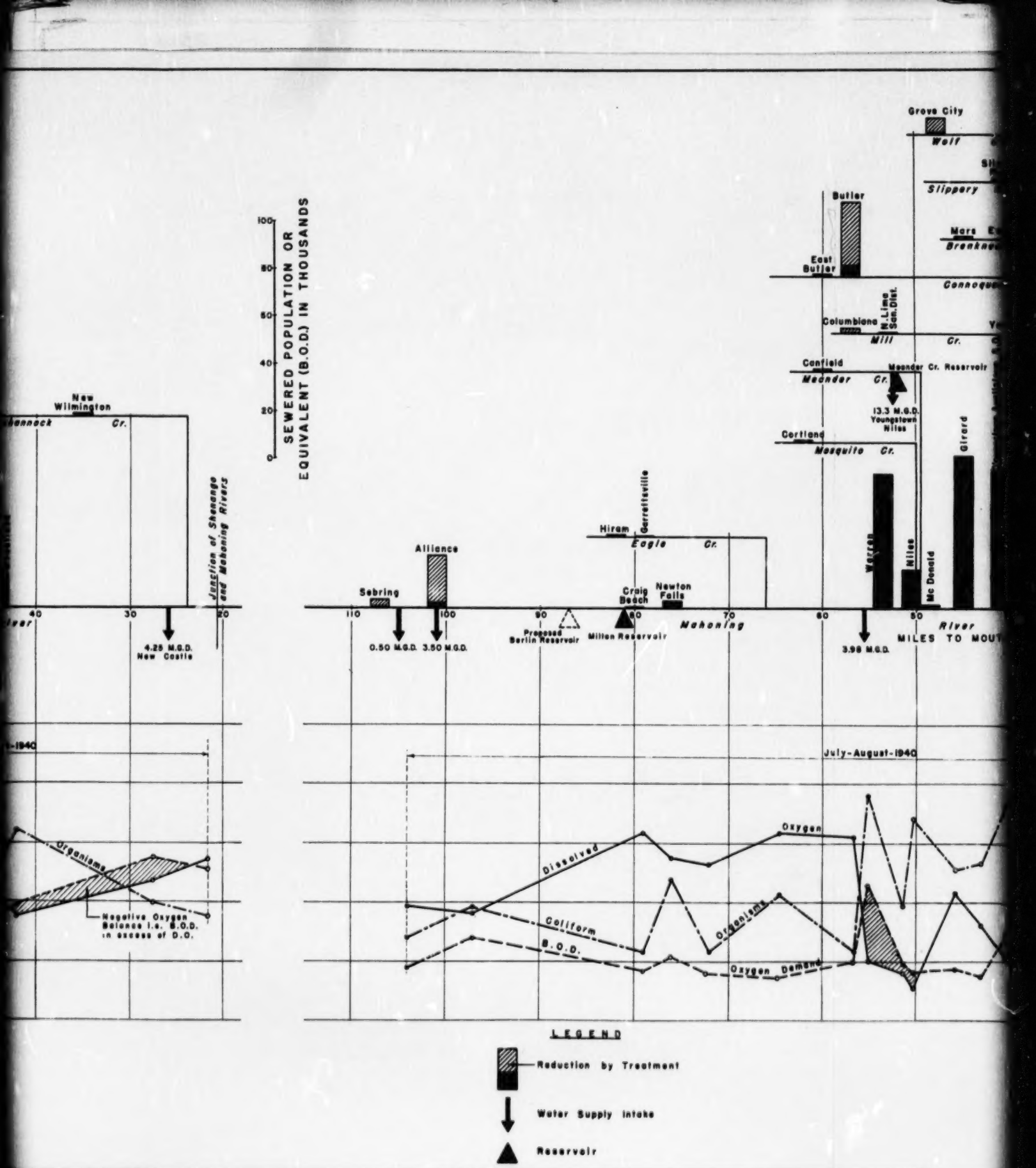
* Exclusive of $FeSO_4$ which exerts some acid effect.

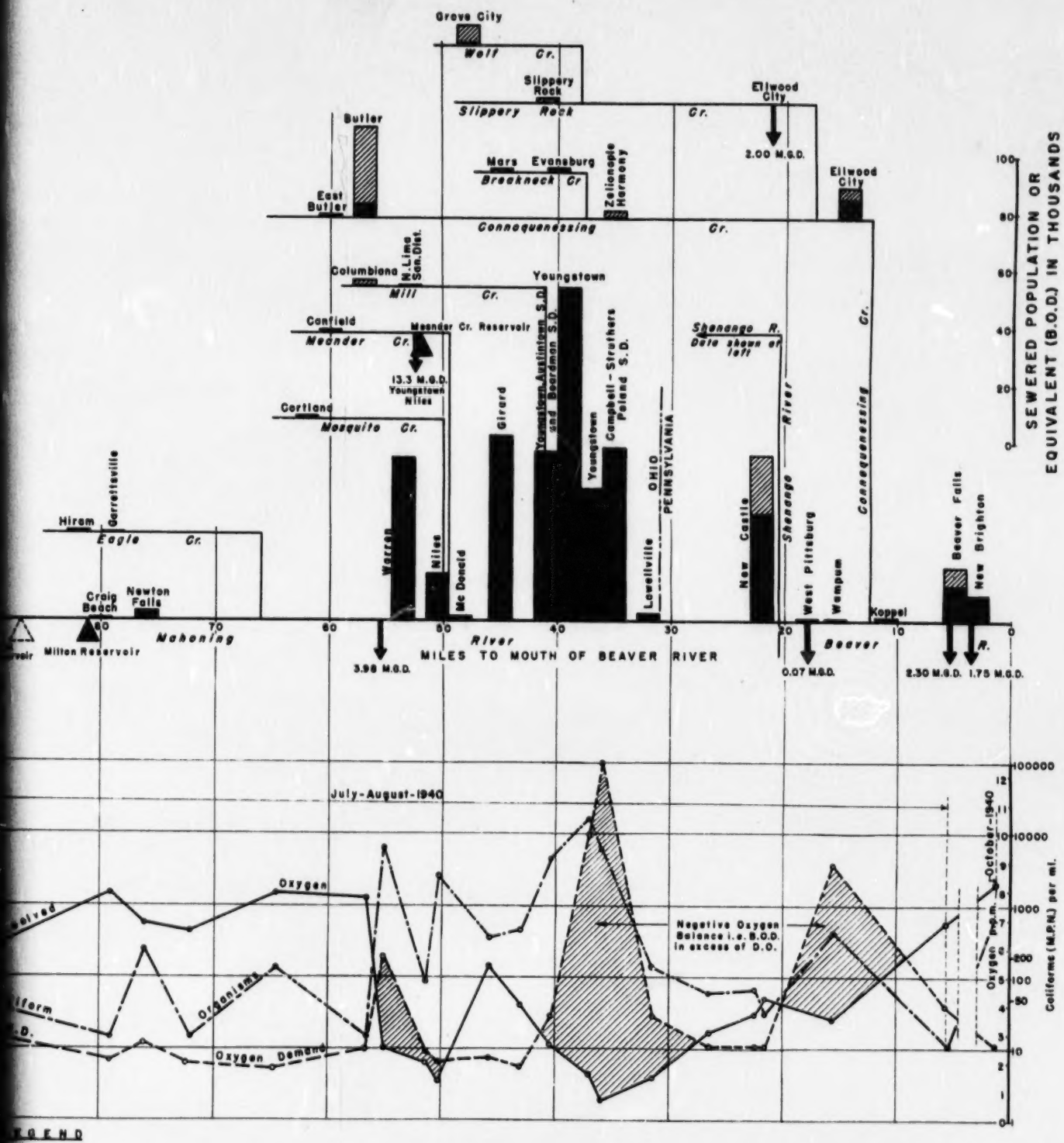
Table B-2 Beaver River Basin - Surface Water Supplies

Municipality	State	Source	Mile (1)	Treatment (2)	Population Served	Cons. M.G.D.
Supplies Below Community Sewer Outfalls						
New Brighton	Pa.	Beaver River	3.6	FD	22,500	1.75
Beaver Falls	"	" "	5.3	FD	25,000	2.30
West Pittsburgh	"	" "	18.0	FD	400	0.07
New Castle	"	Shenango River	25.8	FD	58,000	4.25
Sharon	"	" "	47.5	FD	50,000	3.80
Warren	Ohio	Mahoning River	56.5	LD	42,800	3.98
Alliance	"	" "	101	FD	22,400	3.50
Sebring	"	" "	105	FD	3,900	0.50
Ellwood City	Pa.	Slippery Rock Cr.	21.5	FD	12,000	2.00
Mercer	"	Otter Creek	48.5	FD	2,200	0.12
Youngstown	Ohio	Meander Cr. Res.	52.5	LD	175,000	10.7
Niles	"	" " "	52.5	LD	16,200	2.60
Other Surface Supplies						
Zelionople	Pa.	Impounded-Scholar Run	-	FD	2,000	0.18
Evansburg	"	Wolls-Likens Run	-	F	1,600	0.12
Butler	"	Connoquenessing Creek	61	FD	30,000	3.30
Greenville	"	Impounded-Trib. of L. Shenango	-	FD	8,500	0.50
Struthers	Ohio	Impounded-Yellow Creek	-	FD	13,000	0.65
Campbell	"	" " "	-	FD	13,700	0.56
Total - Below Sewer Outfalls					430,400	35.57
Other					68,800	5.31
Total - Surface Water Supplies					499,200	40.88

(1) Miles above mouth of Beaver River.
(2) L - Lime-soda softened; D - Chlorinated; F - Coagulated, settled, filtered.


SEWERED POPULATION OR EQUIVALENT (R.O.D.) IN THOUSANDS
100
80
60
40
20
0
Mercer
New Wilmington
Neshannock Cr.
0.12 M.G.D.
Hubbard
Yankee Cr.
Sharon
Farrell
Wheatland
Sharpsville
Junction of Shenango and Mahoning Rivers
Greenville
Linesville
Andover
100
90
80
70
60
50
40
30
20
Shenango River
Pymatuning Reservoir
MILES TO MOUTH OF BEAVER RIVER
3.80 M.G.D.
4.25 M.G.D. New Castle
July-August-1940
Oxygen p.p.m.
Coliforms (M.P.N.) per ml.
100000
10000
1000
200
100
50
10
Dissolved Oxygen
B.O.D. Oxygen
Coliform Organisms
Demand
Negative Oxygen Balance i.e. B.O.D. in excess of D.O.


SEWERED POPULATION OR EQUIVALENT (B.O.D.) IN THOUSANDS
100
80
60
40
20
0
Grove City
Wolf
Slippery
Butler
East Butler
Mars
Connoque
Columbiana
N. Lima San. Dist.
Mill Cr.
Canfield
Meander Cr.
Meander Cr. Reservoir
13.3 M.G.D. Youngstown Niles
Cortland
Mosquito Cr.
Girard
Warren
Niles
Mc Donald
Hiram
Garretsville
Eagle Cr.
Alliance
Sebring
Craig Beach
Newton Falls
Proposed Berlin Reservoir
Milton Reservoir
Mahoning River
MILES TO MOUT
0.50 M.G.D.
3.50 M.G.D.
3.98 M.G.D.
New Wilmington
Cr.
Junction of Shenango and Mahoning Rivers
4.25 M.G.D. New Castle
July-August-1940
Organisms
Negative Oxygen Balance i.e. B.O.D. in excess of D.O.
Oxygen
Dissolved
Coliform
Organisms
B.O.D.
Oxygen Demand
LEGEND
Reduction by Treatment
Water Supply Intake
Reservoir



LEGEND

...tion by Treatment

... Supply Intake

...voir

FIGURE - B-2

BEAVER RIVER

SOURCES OF POLLUTION AND SELECTED LABORATORY DATA

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Table B-3 Beaver River Basin - Source of Significant Pollution Including Industrial Wastes, Exprcssed as Sewered Population Equivalent (B.O.D.)

Municipality	State	Receiving Stream	Mile (1)	Population Connected to Sewers	Treat-ment (2)	Sewered Population Equivalent (B.O.D.)	
						Untreated	Discharged
New Brighton	Pa.	Beaver River	3	9,000	None	9,000	9,000
Beaver Falls	"	" "	4	12,000	Pri.	12,000	12,400
Farrell	"	Shenango River	44	14,000	"	14,000	9,100
Sharon	"	" "	45	27,000	"	27,000	17,500
Sharpsville	"	" "	49	5,000	Sec.	5,000	700
Greenville	"	" "	69	8,500	Pri.	8,700	5,600
New Castle	"	Mahoning River	22	50,000	" D.	57,500	37,500
Struthers	Ohio	" "	34	11,700	None	11,700	11,700
Poland C.S.D. (3)	"	" "	35	4,000	"	4,000	4,000
Campbell	"	" "	36	13,700	"	13,700	13,700
Youngstown	"	" "	40	178,700	"	260,500	260,500
Girard	"	" "	44	9,700	"	64,700	64,700
Niles	"	" "	50	16,200	"	16,200	16,200
Warren	"	" "	56	42,800	"	56,800	56,800
Newton Falls	"	" "	76	3,100	"	3,100	3,100
Alliance	"	" "	101	22,000	Sec.	22,000	2,200
Ellwood City	Pa.	Connoquenessing Cr.	14	10,500	Pri.D.	10,500	6,800
Butler	"	" " "	57	27,000	Sec.	31,100	4,700
Crove City	"	Wolf Creek	41	7,000	"	7,000	1,000
Mercer	"	Neshannock Creek	48	2,500	Pri.	2,500	1,600
Hubbard	Ohio	Little Yankee Creek	48	4,100	"	4,100	2,700
Sebring	"	Fish Creek	107	3,500	Sec.	3,500	500
33 smaller sources				26,700	(4)	28,500	16,400
Total - Ohio				321,500		472,800	444,300
. Pennsylvania				194,200		207,300	114,100
Total				515,700		680,100	558,400

(1) Miles above mouth of Beaver River. (2) Pri.-Primary; Sec.-Secondary; D-Chlorination
(3) County Sewer District (4) Ten primary and 11 secondary treatment plants.

As in the case of domestic sewage, the bulk of the organic industrial wastes and of the acid is discharged to the Mahoning River in the Youngstown area.

Industrial Water Supply - About 780 m.g.d. of water are used by the various industries in the basin and about 630 m.g.d. of this are drawn from the Mahoning River in the 25-mile stretch from Warren to Lowellville. Relatively small amounts of this industrial water supply are used as boiler feed and in manufacturing processes. Almost all of it is used as cooling water and is returned to the streams unchanged except for its increased temperature. Since this water demand exceeds even the average flow of the stream, the water must be reused and the temperature increases tend to pyramid. During periods of low stream flow the water temperature below Youngstown has risen often to over 110°F.

Table B-4 Beaver River Basin - Summary of Industrial Wastes not Discharged to Municipal Treatment Plants, with Total of Entire Industrial Waste Load in the Basin.

Industry	Number of Plants	Industrial Waste Disposal		At Least Minor Corrective Measures Taken	Estimated Sewered Population Equivalent (B.O.D.)
		Munic. Sewers	Private Outlets		
Brewing	2	1	1	2	5,300
By-product coke	4	-	4	3	80,400
Chemical	4	1	3	2	-
Meat	2	2	-	2	7,200
Milk	3	1	2	2	3,400
Steel Mill	39	1	38	24	-
Miscellaneous	22	3	19	10	56,300
Waste Unconnected Munic. Treatment	76	9	67	45	152,600
Waste Connected to Municipal Treatment					11,800
Total Industrial Waste in Basin					164,400

Presentation of Laboratory Data

Table B-7 summarizes laboratory data on the Beaver River. Table B-5 shows selected data at some of the more important points. Except for the observations at the mouth of the Beaver, all the results were obtained by a mobile laboratory during June, July and August, 1940. The mouth of the Beaver was sampled in October, November and December, 1940 by the laboratory boat Kiski.

In cooperation with the State Health Departments of Ohio and Pennsylvania, taste and odor problems in the Beaver Basin were studied in November and December, 1940 and January, 1941. Laboratory facilities at Mineral Ridge, Ohio were made available through the courtesy of the Mahoning Valley Sanitary District. Results of this work are summarized in Table B-5A.

Figures B-3, B-4 and B-5 show graphically the coliform, dissolved oxygen and B.O.D. results. These results represent the most unfavorable monthly averages.

The laboratory data indicate clearly the grossly polluted condition of the Mahoning River in its lower 25 miles. The Beaver River is also polluted and the Shenango is in somewhat better sanitary condition. Considering the high degree of industrial development, the large urban population, and the low stream flows, the situation might well be worse.

With the exception of the small community of Linesville, (which has passed a bond issue for sewage treatment) all of the towns in the Shenango Valley have sewage treatment. The most unfavorable results in this valley were obtained below Sharon where about half of the sewage was being bypassed at the time samples were collected during remodeling activities at the sewage treatment plant. The area flooded by Pymatuning Reservoir was formerly a large swamp and the unstable organic matter in the swamp imparts an appreciable B.O.D. to the impounded water.

In the Mahoning Valley, the addition of iron coagulants in the form of waste pickle liquors probably tends to coagulate and settle pollution in the river. In addition, multiple industrial reuse of the river water, causing higher water temperatures and increased time of flow, affords excellent conditions for self-purification. During periods of increased flow and lower temperature, much higher coliform counts and somewhat higher

B.O.D.'s than those observed would probably be found in the Mahoning and the Beaver. In fact, some of the highest coliform counts were the fall and winter observations made at the mouth of the Beaver.

In spite of the amount of pickle liquor discharged in the district, very few pH values found in the district were below 6. Only two pH values below six were observed in the June, July, August period of observation and two more below 6.0 were observed in the November, December, January period when the taste and odor study was being made. In all cases these pH values were well above 5.0.

Hardness in streams of the Shenango Basin and in the eastern tributaries of the Beaver was generally of the order of magnitude of 100 p.p.m. In the Mahoning valley hardness values up to 350 p.p.m. were observed.

Taste and Odor Survey - The data (Table B-5A) have been divided into two sections on the basis of the appearance of phenol in the Beaver at Beaver Falls. During the first period, phenol was present in the Mahoning River in the Youngstown area but self-purification had removed this pollution before the stream reached Beaver Falls. During the second period, due to lower temperatures and shorter times of flow, self-purification failed to remove the phenol from the river before it reached Beaver Falls, where it caused great difficulty in the production of a palatable water.

The laboratory determinations show that large quantities of phenol were entering the Mahoning River in four different sections where by-product coke plants are located.

Table B-5 Beaver River Basin - Selected Laboratory Data

River Location	Mahoning above Alliance	Mahoning below Alliance	Mahoning Waterworks Warren	Mahoning below Warren	Mahoning above McD.Vle Niles	Mahoning McD.Vle Niles	Mahoning Libert St. Girard
River Miles Above:							
Conf. with Shenango	83	76	35.5	34	30.2	29.2	24.8
Mouth of Beaver	104	97	56.5	55	51.2	50.2	45.8
Period - 1940	July	July	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July
Number of Samples	2	2	5	5	5	5	4
Flow in c.f.s.:							
Sampling Days	4	20	235	237	243	290	355
Water Temperature °C.	26.5	26.0	23.9	25.8	25.4	24.6	24.1
Coliforms per ml.	25	83	16	7,100	86	2,400	341
Dissolved oxygen ppm.	4.8	4.5	7.7	2.5	2.0	1.4	5.3
B.O.D.,5-day,p.p.m.	2.2	3.4	2.6	5.7	2.4	2.0	2.2

River Location	Mahoning Division Street Youngstown	Mahoning Center Street Youngstown	Mahoning Sheet & Tube Campbell	Mahoning Bridge Lowell-ville	Mahoning Bridge Edinburg	Mahoning Bridge Mahoning-town	Mahoning near Mouth
River Miles Above:							
Conf. with Shenango	22	16	15	10.5	5.5	1.5	0.5
Mouth of Beaver	43	37	36	31.5	26.5	22.5	21.5
Period - 1940	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.
Number of Samples	8	8	8	8	8	7	4
Flow in c.f.s.:							
Sampling Days	294	260	280	291	307	367	214
Water Temperature °C.	27.2	29.6	30.0	29.2	26.1	25.9	23.9
Coliforms per ml.	450	11,400	6,100	186	62	71	31
Dissolved oxygen ppm.	4.0	1.6	0.7	1.6	3.1	3.7	4.3
B.O.D.,5-day,p.p.m.	1.8	10.0	12.4	3.7	2.6	2.6	2.6

River Location	Shenango Riverside Hotel Greenville	Shenango below Greenville	Shenango Mercer St. Sharpsville	Shenango Clark St. Sharpsville	Shenango below Sharon-Farrell	Shenango above New Castle	Shenango below New Castle
River Miles Above:							
Conf. with Mahoning	48	46.5	31	29.3	21	6.5	0.5
Mouth of Beaver	69	65.5	52	50.3	42	27.5	21.5
Period - 1940	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.	July-Aug.
Number of Samples	5	5	5	5	5	6	5
Flow in c.f.s.:							
Sampling Days	122	133	226	262	268	274	325
Water Temperature °C.	20.8	21.3	22.4	22.6	23.7	22.7	21.4
Coliforms per ml.	41	280	233	22	1,800	98	58
Dissolved oxygen ppm.	7.6	6.6	7.8	6.9	4.4	5.9	6.8
B.O.D.,5-day,p.p.m.	3.6	4.1	3.4	3.3	5.0	6.9	6.4

River Location	Beaver bel.New Castle	Beaver Eastvale, B'r Falls	Beaver near Mouth	Neshan Cr below Mercer	Connoquenessing Creek at Butler	Connoquenessing Creek below Butler	Connoquenessing Creek at Renfrew
River Miles Above:							
Mouth of Beaver	15.5	5.5	1.4	46.5	57.5	54.0	49
Period - 1940	July-Aug.	July-Aug.	Oct.	Aug.	July	July	July
Number of Samples	6	6	11	2	2	2	2
Flow in c.f.s.:							
Sampling Days	502	750	633	11	10	20	30
Water Temperature °C.	24	23.8	15.2	20.2	24.5	26.0	25.5
Coliforms per ml.	437	10	802	330	5	13	58
Dissolved oxygen ppm.	3.5	6.8	8.3	5.0	5.0	3.4	6.6
B.O.D.,5-day, p.p.m.	8.8	4.0	2.6	2.3	1.1	6.1	3.6

Table B-5A - Beaver River Basin - Laboratory Results of Taste and Odor Survey of Mahoning and Beaver Rivers from Warren, Ohio to mouth.

River	Location of Sampling Point	River Mile (1)	Number of Samples	Temp. °C.	Phenol-parts per billion			Threshold Odor Value			pH	Iron p.p.m.
					Max.	Min.	Ave.	Max.	Min.	Ave.		
PERIOD OF SELF-PURIFICATION (11/7/40-12/3/40) Average discharge Beaver River at Beaver Falls 2036 c.f.s.												
Mahoning	Above Warren	64.5	10	3.9	2	0	0.2	16	2	6	7.4	2.8
"	" Niles	51.2	4	4.0	250	80	156	16	8	10	6.5	27
"	Below "	50.2	10	6.3	220	70	141	16	4	8	6.3	17
"	Youngstown (Division St.	43.0	10	7.6	140	2	87	16	4	8	6.4	11
"	Youngstown (Mahoning Ave.	40.3	10	12.2	320	5	164	32	4	13	6.6	6.4
"	Youngstown (Center St.	37.0	5	10.8	240	20	130	16	4	11	6.6	16
"	Campbell at Youngstown Sheet & Tube Br.	36.0	10	14.2	1600	30	777	256	16	80	6.3	18
"	Struthers Bridge	34.6	0									
"	Lowellville Bridge	31.5	8	15.2	1000	38	502	64	8	29	6.2	19
"	Mt.Jackson Hwy.Br.	22.5	8	7.8	800	10	156	32	8	15	7.1	1.3
Shenango	New Castle Viaduct	23.0	8	5.2	0	0	0	16	2	6	6.9	5.5
Beaver	Above Beaver Falls	5.5	8	4.1	2	0	0.2	8	2	4	6.7	5.3
PERIOD OF PHENOLIC CONTAMINATION (12/4/40 - 1/10/41) Average discharge Beaver River at Beaver Falls, 6330 c.f.s.												
Mahoning	Above Warren	64.5	13	2.1	2	0	.35	8	2	3	7.0	1.1
"	" Niles	51.2	13	4.0	600	0	141	16	2	8	6.4	18
"	Below "	50.2	13	3.6	180	0	83	16	2	6	6.4	12
"	Youngstown (Division St.	43.0	13	4.3	120	0	61	8	2	5	6.4	13
"	Youngstown (Mahoning Ave.	40.3	13	5.6	800	10	223	8	4	6	6.4	13
"	Youngstown (Center St.	37.0	13	6.9	400	30	159	64	4	27	6.5	11
"	Campbell at Youngstown Sheet & Tube Br.	36.0	13	7.4	1000	60	570	128	16	41	6.4	13
"	Struthers Bridge	34.6	10	8.5	2000	90	929	256	16	59	6.5	16
"	Lowellville Bridge	31.5	11	8.0	1800	160	824	128	16	41	6.5	16
"	Mt.Jackson Hwy. Br.	22.5	11	8.3	1800	50	685	128	8	29	6.6	9
Shenango	New Castle Viaduct	23.0	10	3.9	15	0	3.5	8	0	3	6.8	2.4
Beaver	Above Beaver Falls	5.5	11	4.8	230	35	108	64	2	11	6.7	2.3

(1) Miles above mouth of Beaver River.

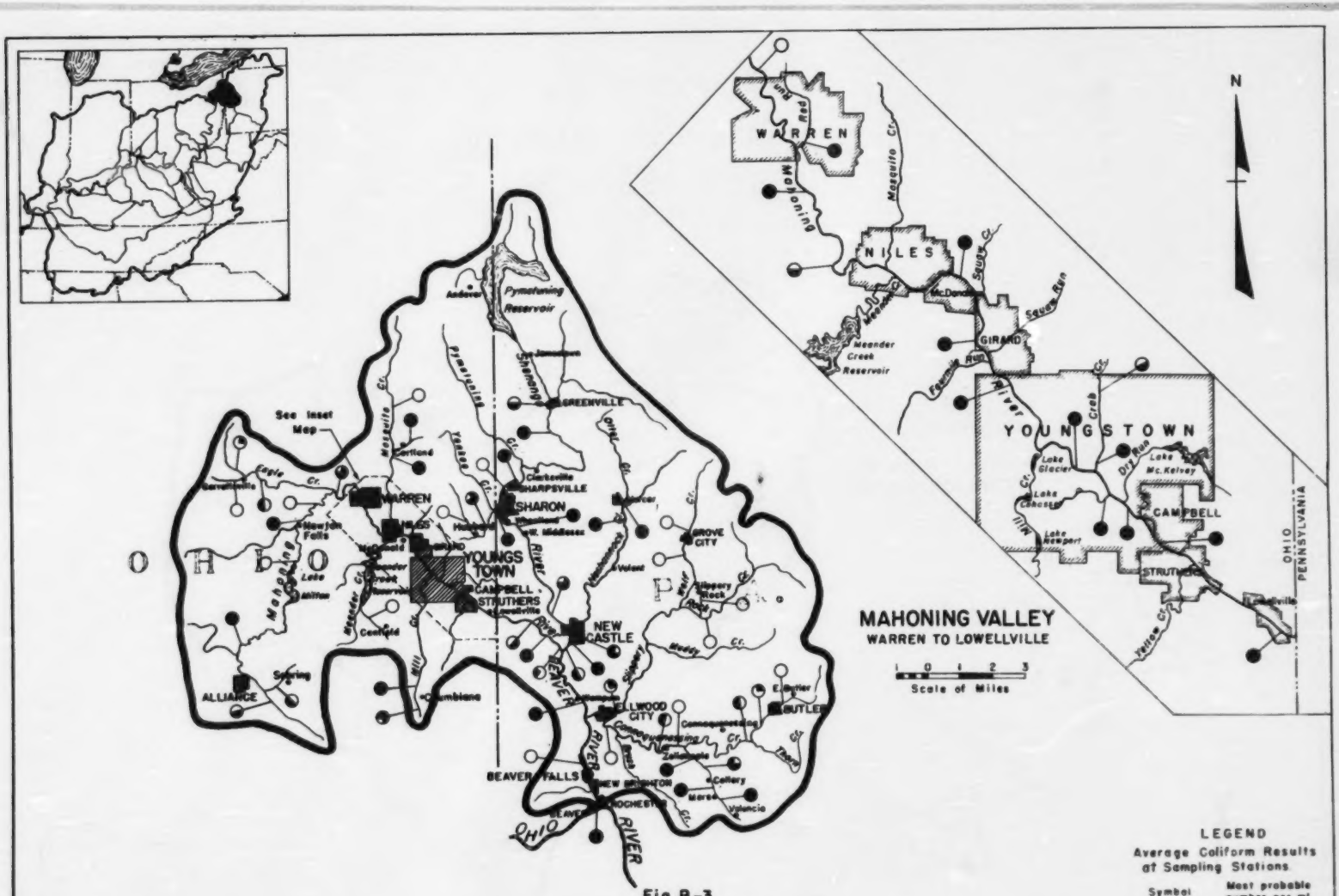


Fig. B-3

BEAVER BASIN

COLIFORM RESULTS

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. B-3

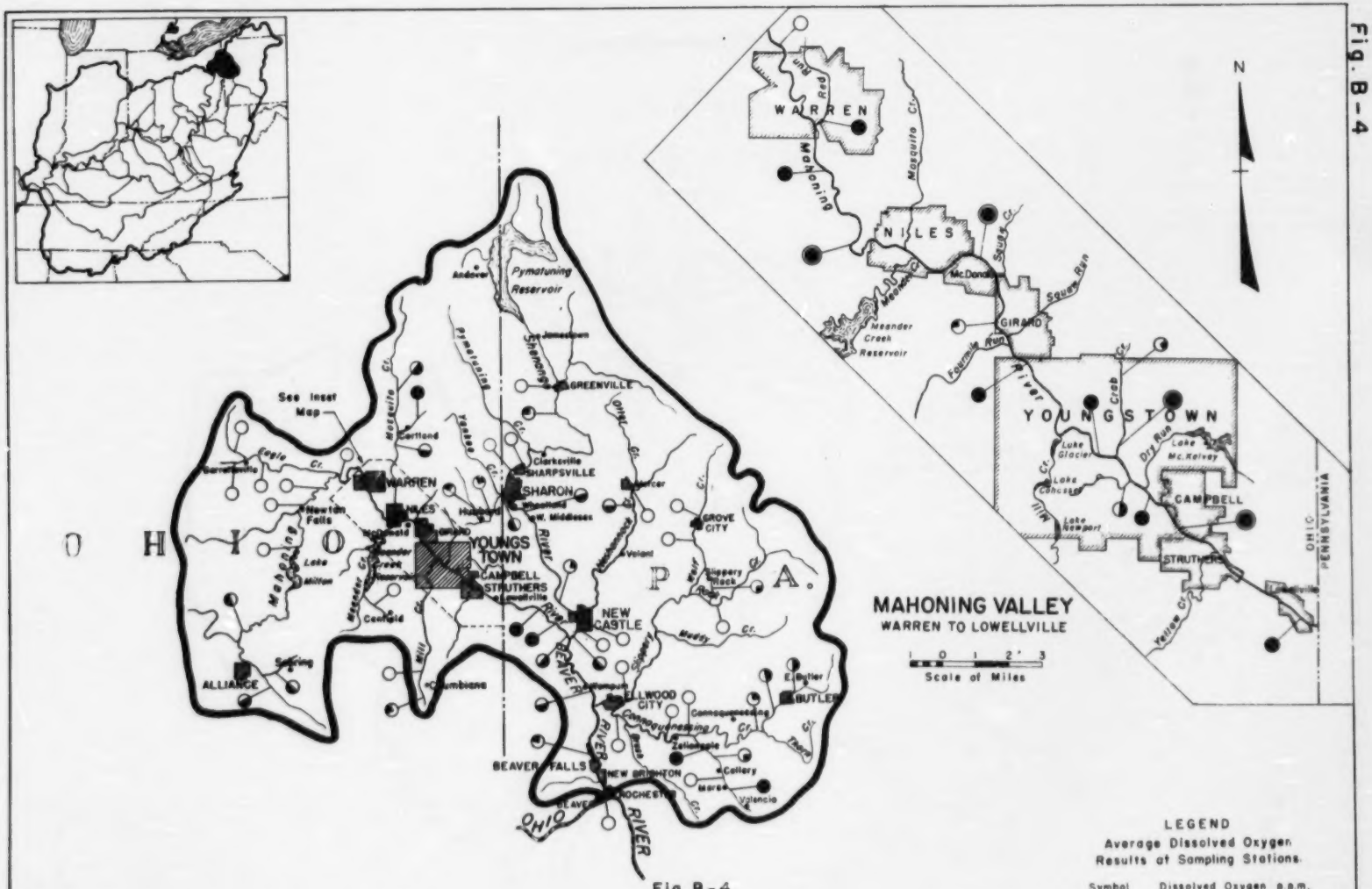


Fig. B-4

BEAVER BASIN

DISSOLVED OXYGEN RESULTS

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. B-4

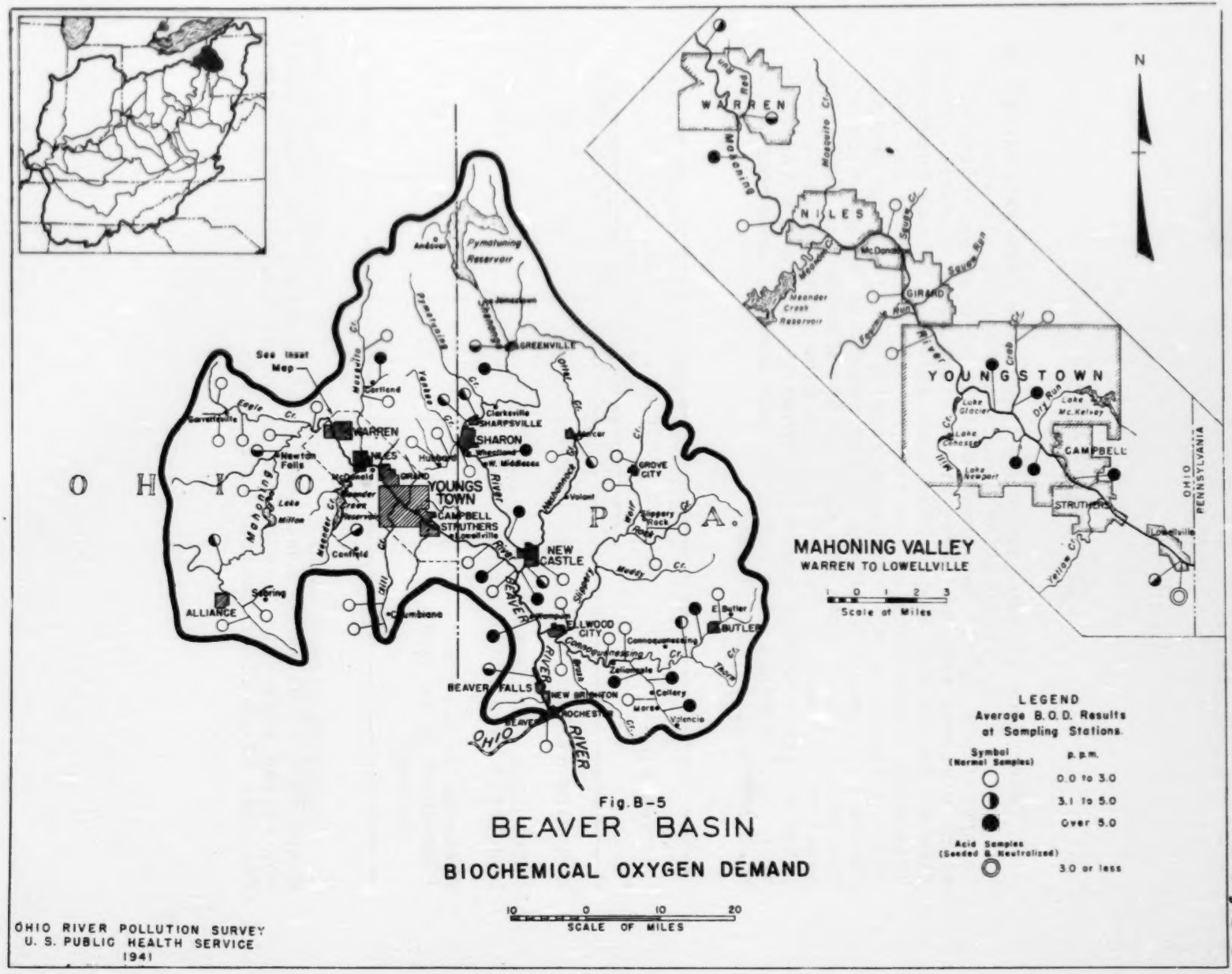


Fig. B-5

BEAVER BASIN

BIOCHEMICAL OXYGEN DEMAND

OHIO RIVER POLLUTION SURVEY
U. S. PUBLIC HEALTH SERVICE
1941

Fig. B-5

Hydrometric Data

Twenty-one stream gaging stations have been maintained in the Beaver River Basin at various times and 14 are currently in operation. Table B-6 shows monthly mean summer flows at eight stations for the three driest summers of record. Stream flow at Sharon and Wampum have been affected by the Pymatuning Reservoir since 1933 so the records shown in Table B-6 for these stations do not represent conditions likely to recur. Figure B-6 shows the effect of the reservoir on the flow at Sharon. It also shows the flow in the Mahoning at Youngstown based on 18 years of record and the flow as it would be regulated by the proposed Berlin Reservoir. Figure B-6 indicates that the frequency with which minimum monthly mean summer flows have occurred is as follows:

Location	Minimum Monthly Mean Summer Flows in Cubic Ft. per Sec. that may be expected once in			
	2 Years	5 Years	10 Years	Minimum
Mahoning at Youngstown	133	94	75	47
Mahoning at Youngstown Regulated by Berlin Res.	183	165	162	160
Shenango at Sharon (Unregulated at Pymatuning)	54	33	21	7

Proposed Stream Control - The Corps of Engineers has determined four sites to be most nearly satisfactory for flood control and allied reservoir development in connection with the program for Ohio River flood control as follows:

Reservoir	Stream	River Miles Above Mouth of Beaver River	Storage Acre-Ft.	Supplemental Flow Made Available c.f.s.	Approx. Minimum Regulated Summer Discharge at Project Sites-c.f.s.
Shenango	Shenango R.	54	127,000	100	(1) 300
Berlin (2)	Mahoning R.	94	71,000	113	(3) 160
Eagle Cr.	Eagle Creek	65	48,100	31	43
Mosquito Cr.	Mosquito Cr.	59	50,000	34	35

(1) Includes effect of Pymatuning.
(2) Under construction - 1942.
(3) Ultimate at Youngstown.

It is assured that low-flow control will be made available in the near future by the Berlin Reservoir project, and, during the present national emergency, it is proposed to operate the reservoir primarily for low-flow control with flood control as an incidental feature. Plans for ultimate operation contemplate its use for flood control, with secondary low water regulation. The Berlin project, operated in conjunction with existing Milton Reservoir several miles downstream, will permit sustaining a minimum flow of about 250 second-feet in the Mahoning River at Youngstown, Ohio, during the national emergency period, and about 160 second-feet under the ultimate plan of operation. The Eagle and Mosquito Creek projects would be capable of further augmenting discharge in the main river as well as increasing minimum flows in their respective tributary channels.

The Shenango project, if provided, would be operated with due regard for flow regulation originating in the Pymatuning Reservoir, which is situated further upstream. Proposed operations contemplate increasing the regulated flow of the Shenango River by 100 second-feet during the months of June to September, inclusive. Minimum regulated discharge at Sharon, Pennsylvania, which would reflect operation of both reservoirs, would approximate 300 second-feet during these months.

Table B-6 Beaver River Basin - Monthly Mean Summer Flows for Years in Which Low Summer Flows have Occurred.

River Location	Mahoning R. Warren, Ohio	Mahoning R. Youngstown, Ohio	Shenango at Sharon, Pa.	Shenango at New Castle, Pa.
River Miles Above: Mouth of Beaver	56.5	41.8	45.5	24.3
Drain.Area Sq.Mi.	599	899	608	792
Period of Record	1924-35	1921-39	1909-38	1910-34
Year	1930	1930	1916	1933
June c.f.s.	124	177	128	207
July "	80	104	18	40
August "	35	47	7	19
September "	37	56	9	26
Year	1934	1934	1930	1930
June "	44	66	99	142
July "	43	66	53	67
August "	83	198	14	25
September "	195	274	18	30
Year	1933	1933	1932	1923
June "	179	280	70	102
July "	59	82	120	31
August "	55	86	27	26
September "	44	71	17	36

River Location	Beaver R. at Wampum, Pa.	Mosquito Cr. Niles, Ohio	Connoque-nessing Cr. at Hazen,Pa.	Slippery Rk. Cr.at Wurtem-burg,Pa.
River Miles Above: Mouth of Beaver	15.4	51	23	18.5
Drain.Area Sq.Mi.	2,235	139	356	406
Period of Record	1914-18 1933-39	1929-39	1920-39	1912-39
Year	1916	1933	1930	1930
June c.f.s.	1,884	11.5	254	233
July "	559	2.3	26	66
August "	167	0.1	11	35
September "	153	0.2	11	40
Year	1933	1934	1939	1914
June "	720	0.3	290	184
July "	203	0.2	139	67
August "	156	23.6	54	38
September "	157	6.1	17	48
Year	1934	1930	1923	1932
June "	222	6.2	234	84
July "	201	1.4	40	127
August "	970	0.2	20	49
September "	578	0.2	21	42

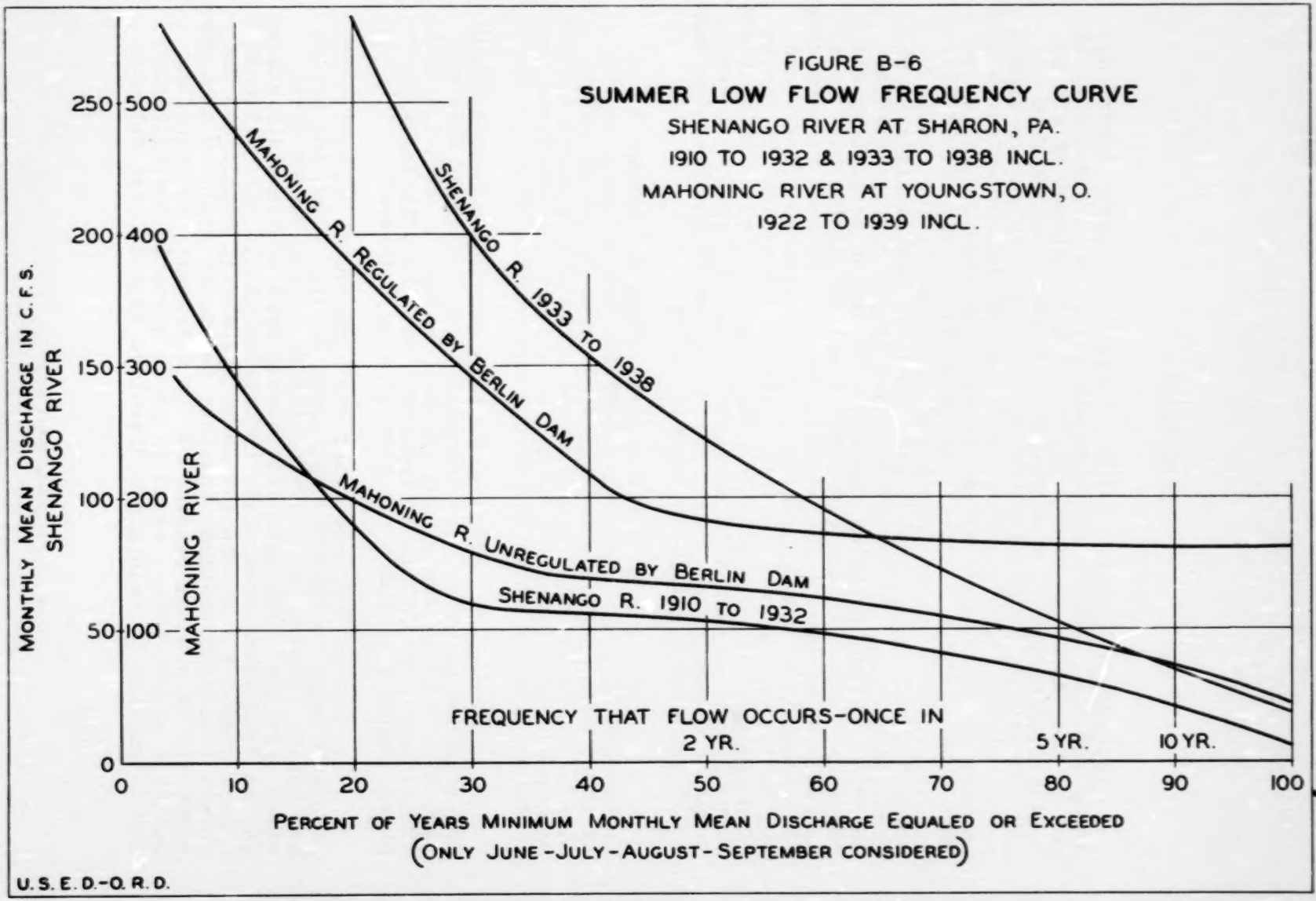


FIGURE B-6
SUMMER LOW FLOW FREQUENCY CURVE
SHENANGO RIVER AT SHARON, PA.
1910 TO 1932 & 1933 TO 1938 INCL.
MAHONING RIVER AT YOUNGSTOWN, O.
1922 TO 1939 INCL.
MONTHLY MEAN DISCHARGE IN C.F.S.
SHENANGO RIVER
MAHONING RIVER
250
500
200
400
150
300
100
200
50
100
0
0
10
20
30
40
50
60
70
80
90
100
MAHONING R. REGULATED BY BERLIN DAM
SHENANGO R. 1933 TO 1938
MAHONING R. UNREGULATED BY BERLIN DAM
SHENANGO R. 1910 TO 1932
FREQUENCY THAT FLOW OCCURS-ONCE IN
2 YR.
5 YR.
10 YR.
PERCENT OF YEARS MINIMUM MONTHLY MEAN DISCHARGE EQUALED OR EXCEEDED
(ONLY JUNE-JULY-AUGUST-SEPTEMBER CONSIDERED)
U.S.E.D.-O.R.D.

Fig. B-6

Discussion

Youngstown District - The Mahoning and Beaver Rivers are among the most grossly polluted streams in the Ohio Basin, if not in the entire country. In the 25-mile stretch of the Mahoning from Warren to Lowellville, untreated sewage from 280,000 people, industrial wastes equivalent to sewage from an additional 150,000 people and about 32 tons of sulfuric acid per day are discharged to the river whose flow has fallen to less than 50 c.f.s. A total of about 630 m.g.d. (about 980 c.f.s.) is used by the industries, principally for cooling water, in this same stretch of river with the result that the temperature rises to 30°-40°F. above normal during low-flow periods. These increased temperatures hinder production and increase costs. At certain times steel production has had to be reduced because of low stream flows. Increased temperatures also accelerate the decomposition of the organic matter present in the sewage and industrial wastes and reduce the amount of dissolved oxygen which the water can contain. Both of these effects tend to aggravate nuisance conditions in the stream. Complete depletion of the dissolved oxygen in the Mahoning was found at several points during the survey.

Three public water supplies from the Beaver River are affected by all the wastes entering the Mahoning as well as the treated wastes which are discharged to the Shenango River. Taste and odor problems are particularly acute at these places and even after very complete and careful treatment the finished water is often malodorous and unpalatable.

Survey information on taste and odor determinations on the Mahoning River were released to the State of Ohio and served as a basis for phenol control discussion with the industries. As a result, it is reported that the efficiency of phenol removal measures has been greatly increased.

Sewage and industrial waste treatment is obviously necessary both to improve conditions locally along the Mahoning and to relieve the heavy pollution of the Beaver River water supplies. The intensive development of the river valley in the Youngstown area where industrial plants and railroads occupy almost all of the available space will complicate the sewage treatment problem. Complete treatment would be much more expensive than usual because of the difficulty of acquiring suitable sites. There seems to be no economic justification for attempting to maintain a dissolved oxygen level suitable

for fish propagation in this stretch of the river. The high temperature of the river water would make the stream unsuitable for any fish native to this area and the highly industrialized nature of the valley makes the stream unattractive for recreational use.

Chemical treatment of sewage and such industrial wastes as can be effectively treated in the municipal plants together with a maximum of recovery and reuse of wastes at the by-product coke plants (with particular attention to phenol removal), neutralization or other treatment of acid wastes are essential elements in a practicable program for pollution abatement in the Mahoning Valley.

Low-flow augmentation by reservoirs seems to be another essential part of any practicable program for improving the stream quality. Such low-flow control would reduce stream temperatures and benefit industrial water users and would reduce the hardness of the water as well as supplement sewage treatment and industrial waste corrective measures in the abatement of pollution from organic wastes. The benefits from low-flow control by the Berlin reservoir now (1942) under construction are estimated at $251,000 annually, provided the entire capacity is used for flow regulation as is planned for the period of the national emergency. The approximate distribution of the annual benefits is as follows:

Organic Pollution Abatement	$133,000
Industrial Water Supply- Temperature reduction and increased industrial activity made possible	112,000
Hardness Reduction	6,000
Total	$251,000

Under the ultimate plan of operation, or after the national emergency, the reservoir will be used primarily for flood control. One-third of the reservoir capacity will be used during the off-flood season for flow regulation. Annual flow regulation benefits will then be reduced to $111,000.

Additional flow regulation by Eagle Creek and Mosquito Creek reservoirs would have additional benefits. However, sewage treatment is necessary if full benefits are to be realized. Low-flow augmentation alone, or without the parallel program of sewage treatment, will actually have a detrimental effect on pollution conditions in the Beaver River because of decreased time of flow. This is particularly true as regards bacterial and taste and odor conditions.

No amount of flow regulation will entirely supplant sewage or industrial waste treatment measures but will supplement them. In the case of the most troublesome type of industrial waste, phenols, flow regulation by the proposed reservoirs would have no appreciable effect.

The Mahoning River presents a most promising situation for the advantageous use of low-flow augmentation. Monetary benefits are substantial and intangible values connected with any program of pollution control furnish additional incentive. However, due in part to the comparatively high storage costs experienced in this locality, even the Berlin Reservoir cannot be shown to be economically feasible for low-flow control alone. A multiple-purpose project has been shown to be economically feasible.

Treatment methods as outlined and maximum emergency period low-flow control by the Berlin Reservoir, together, would still not insure the continuous maintenance of 3.0 parts per million of oxygen in the Mahoning which is regarded as a minimum necessary to prevent nuisance conditions. However, such conditions would prevail only for a short distance and at infrequent intervals. The quality of the water at downstream water intakes would be greatly improved.

Shenango River - There are no serious pollution problems along this stream. All of the wastes entering the river are treated and flow regulation by Pymatuning Reservoir aids further in improving the water quality. Additional regulation by the proposed Shenango Reservoir would be of value, particularly in improving the quality of water in the Beaver River but the monetary benefit would be relatively minor.

Other Streams - On the whole, the smaller tributary streams of the Beaver Basin are not heavily polluted. Almost all of the towns have sewage treatment facilities although a number of them are inadequate. In general, secondary treatment is indicated at these places. At Newton Falls and Craig Beach on the Mahoning between the proposed Berlin Reservoir and Warren and at New Brighton, the only sizable Pennsylvania town without sewage treatment, primary treatment is indicated.

Costs - The estimated cost of the suggested program of sewage and industrial waste treatment, together with estimates of the cost of existing works and of possible programs for primary or for secondary treatment of all wastes are shown in Table B-1.

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Fish Run 3 miles below Sebring, Ohio	BMaF 104	June 28	1	20.0	5.0	55.1	1.9	91	7.2	26	101	252
" "	" "	July 10	1	24.0	5.0	58.3	1.3	4	7.6	20		260
" "	" "	" 29	2	26.0	3.2	38.4	2.7	43	6.9	28		220
Mahoning River 1 mile east of Alliance, Ohio	BMa 104	June 28	36	20.5	7.4	81.1	1.3	93	7.4		117	
" "	" "	July 10	3	24.0	5.9	69.2	1.2	4	7.6			
" "	" "	" 29	6	27.0	3.7	45.5	3.2	46	7.3			
Mahoning River 5 miles below Alliance, Ohio	BMa 97	June 28	42	21.0	5.4	59.8	3.0	430	7.5	37	136	174
" "	" "	July 10	7	24.0	4.2	49.8	3.3	73	7.6	23		194
" "	" "	" 29	34	27.0	4.8	59.2	3.4	93	7.3	32		156
Mahoning River 3 miles abv. Newton Falls, Ohio	BMa 79	July 1	93	16.5	8.1	86.7	2.2	4	7.4		53	
" "	" "	" 15	132	22.0	8.9	101.0	1.8	2	7.3			
" "	" "	" 22	130	25.0	7.9	94.0	1.0	24	7.2			
" "	" "	July 30	88	27.5	7.0	87.5	3.0	24	7.3			
" "	" "	Aug. 5	86	25.0	7.4	88.1	2.6	24	7.3			
Mahoning River lower edge of Newton Falls, O.	BMa 76	July 1		16.0	7.2	72.4	1.9	230	7.4		49	
" "	" "	" 15	147	21.0	7.7	85.9	1.3	43	7.5			
" "	" "	" 22	167	25.0	6.9	82.8	2.2	240	7.2			
" "	" "	" 30	90	26.5	5.5	67.4	3.8	460	7.2			
" "	" "	Aug. 5	90	24.5	6.3	75.0	4.2	93	7.2			
Mahoning River 4 miles below Newton Falls, Ohio	BMa 72	July 1	147	16.0	7.9	79.2	1.8	36	7.4		58	
" "	" "	" 22	213	27.5	6.7	84.4	1.6	9	7.5			
" "	" "	" 30	104	26.5	5.3	65.4	2.8	2	7.2			
" "	" "	Aug. 5	101	24.5	6.6	78.5	1.9	24	7.2			
Silver Cr. 2 miles abv. Garrettsville, Ohio	BMaSS 82	June 27		14.5	9.0	87.5	0.5	4	7.4		94	
" "	" "	July 29	1	25.0	8.9	106.1	0.8	2	7.8	5		126
Eagle Creek 2 miles abv. Garrettsville, Ohio	BMaE 82	June 27		16.5	8.5	86.4	2.2	36	7.4	27	75	104
" "	" "	July 11	3	21.0	7.0	78.0	0.9	2	7.4			
" "	" "	" 29	3	24.0	6.6	77.3	4.7	46	7.4			
Eagle Creek 2 miles bel. Garrettsville, Ohio	BMaE 78	July 11	20	23.0	7.4	85.0	1.4	93	7.8	18		138
" "	" "	" 29	9	26.5	6.5	80.2	1.6	23	7.7	12		144
Mahoning River 2 miles North of Leavittsburg, Ohio	BMa 64.5	July 1	477	15.0	8.5	83.5	1.7	150	7.3		55	
" "	" "	" 15	248	21.0	8.5	94.7	1.5	150	7.4			
" "	" "	" 22	206	25.0	7.6	92.8	1.9	9	7.5			
" "	" "	" 30	105	27.0	7.5	92.4		240	7.6			
" "	" "	Aug. 5	112	24.5	7.7	90.7	2.0	4	7.3	15		116
Mahoning River Water works intake Warren, Ohio	BMa 56.5	July 1	567	17.0	7.7	79.5	2.4	36	7.3		47	196
" "	" "	" 15	204	21.5	8.4	94.2	1.8	9	7.6	23		116

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	California M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Mahoning River Water works intake Warren, Ohio	BMa 56.5	July 22	200	26.5	7.5	91.9	1.8	9	7.4			
" "	" "	" 30	106	27.5	7.7	95.7	2.5	4	7.6			
" "	" "	Aug. 6	100	27.0	7.1	87.9	4.7	24	7.4	17		352
Bar Run Erie R.R. Bridge Below Warren, Ohio	BMaR 56.0	July 1	5	16.0	2.4	23.6	2.9	73	7.3	16	126	
" "	" "	" 15		19.5	1.5	16.4	5.0	4	7.4	10		152
" "	" "	" 22	1	25.0	0.5	6.4	3.8	240	7.4			
" "	" "	" 30	**	25.5	0.8	9.8	6.7	240	7.2	10		180
" "	" "	Aug. 6	**	24.0	0.6	7.3	3.8	2,400	7.8			
Mahoning River 1 mile below Warren, Ohio	BMa 55.0	July 1	581	18.5	6.8	73.1	3.6	430	6.6		50	
" "	" "	" 15	180	24.0	2.2	26.0	10.4	930	6.1			
" "	" "	" 22	200	30.0	3.0	38.7	2.9	750	7.2	14		146
" "	" "	" 30	108	29.0	0.0	00.0	7.5	24,000	7.0			
" "	" "	Aug. 6	116	27.5	0.4	4.4	4.3	9,300	7.0			
Mahoning River 1 mile above Niles, Ohio	BMa 51.2	July 2	594	18.0	6.6	69.6	2.5	230	6.8	64	59	122
" "	" "	" 15	186	21.0	2.0	21.9	3.5	91	6.1			
" "	" "	" 22	192	30.0	1.3	17.3	1.9	23	6.1			
" "	" "	" 30	110	30.0	0.0	00.0	1.8	43	6.0			
" "	" "	Aug. 6	132	28.0	0.0	00.0	2.3	43	6.1			
Walnut Creek 1 mile above Cortland, Ohio	BMaW 63.0	June 27	1	16.5	8.1	82.4	1.5	75	7.2	14	87	94
" "	" "	July 11	14	22.0	5.2	58.9	1.0	2,400	6.6	21		78
" "	" "	Aug. 5	**	24.3	1.4	17.0	13.7	4,600	7.6			
Mosquito Creek 4 miles above Cortland, Ohio	BMaM 64.0	June 27	23	16.5	6.4	64.9	2.5	23	7.1		78	
" "	" "	July 11	3	22.0	3.4	38.8	1.0	24	7.2			
" "	" "	Aug. 5	**	26.0	5.0	60.6	2.8	23	7.5	34		170
Mosquito Creek 2 miles below Cortland, Ohio	BMaM 58.0	June 27	32	18.0	5.9	62.1	2.2	36	7.3	19	108	122
" "	" "	July 11	19	22.5	3.5	39.9	2.7	460	6.4	34		116
" "	" "	Aug. 5	**	25.5	5.7	69.0	2.7	4	7.4	28		148
Bay Mill Creek Bridge on county road Canfield, Ohio	BMaMcS 60	July 3	1	22.5	12.3	140.7	3.6	36	9.2	12		256
" "	" "	" 29	**	23.5	6.0	69.7	3.1	9	7.8	8		184
" "	" "	Aug. 5	**	23.0	7.0	80.6	2.9	1	7.8	2		220
Mahoning River Niles McDonald Viaduct Below Niles, Ohio	BMa 50.2	July 2	708	18.5	6.4	67.5	3.5	430	6.6		43	
" "	" "	" 15		21.0	0.4	4.7	2.1	91	6.1	37		136
" "	" "	July 22	205	29.0	0.0	00.0	1.3	75	6.1	37		132
" "	" "	" 30	111	28.0	0.0	00.0	1.6	430	6.1			
" "	" "	Aug. 6	149	26.5	0.0	00.0	1.9	11,000	6.1			
Mahoning River Girard, O. Bridge Girard, Ohio	BMa 45.8	July 2	879	16.5	6.5	66.2	2.9	430	6.6		37	
" "	" "	" 16	251	23.0	5.7	69.4	2.4	430	6.4			
" "	" "	" 23	170	29.0	5.1	65.1	1.5	430	6.2			
" "	" "	" 30	120	28.0	4.1	51.3	1.8	73	6.1	34		130

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Mahoning River Lynch St. Bridge Youngstown, Ohio	BMa 43	July 2	1,210	16.5	7.1	72.2	3.4	2,400	6.8		46	
" "	" "	" 16	256	22.5	5.2	59.2	1.6	91	6.2			
" "	" "	" 23	199	29.0	4.1	52.5	1.2	43	6.1			
" "	" "	" 31	134	29.5	3.5	45.2	2.0	240	6.1			
" "	" "	Aug. 6	185	29.5	2.9	37.7	0.8	21	6.0			
" "	" "	" 9	132	29.0	3.5	45.2	2.3	430	6.4			
" "	" "	" 13	120	31.0	2.8	37.5	1.9	240	6.1			
" "	" "	" 14	115	31.0	2.7	36.0	1.6	150	6.0			
Mill Creek 1 mile above Columbiana, Ohio	BMaM1 57.5	June 26	4	15.5	7.9	78.5	1.4	43	7.8		250	
" "	" "	" 28	4	18.0	6.1	63.6	0.4	46	7.8			
" "	" "	July 10	1	19.5	3.8	40.6	3.4	460	7.5			
Mill Creek 1 mile below Columbiana, Ohio	BMaM1 55.5	June 26	15	15.0	7.4	73.0	3.6	2,400	7.6	7	176	180
" "	" "	" 28	15	17.0	7.2	74.1	1.1	73	7.4	8		214
" "	" "	July 10	2	19.0	5.2	55.2	3.0	430	7.5	25		170
Mahoning River Spring Common Bridge Youngstown, Ohio	BMa 40.2	June 25		25.0	4.5	53.9	4.1	2,400	7.0		44	
" "	" "	July 2	1,290	17.0	6.7	68.4	3.4	930	6.9	47		112
" "	" "	" 16	299	24.5	2.7	31.6	3.2	2,400	6.5			
" "	" "	" 23	178	32.5	2.1	28.6	2.4	2,400	6.6			
" "	" "	" 31	140	33.0	2.4	33.5	3.9	9,300	6.3			
" "	" "	Aug. 6	187	31.5	0.8	10.6	6.4	4,600	6.7	8		204
" "	" "	" 9	134	31.5	2.3	30.6		9,300	6.7			
" "	" "	" 13	124	32.5	1.9	25.5	5.0	4,600	6.6			
" "	" "	" 14	117	32.0	1.8	24.3	5.4	4,600	6.7			
Crab Creek Applegate Road, Youngstown, Ohio	BMaC 41	July 2	17	15.5	9.3	92.4	1.1	21	7.2		67	
" "	" "	" 16	1	18.5	7.5	79.1	1.1	4	7.5			
" "	" "	" 23	2	25.0	3.8	45.6	1.0	23	7.4			
" "	" "	" 31	1	25.0	5.9	69.9	1.9	240	7.4			
" "	" "	Aug. 6	1	22.5	5.2	59.3	1.4	93	7.5			
" "	" "	" 9	1	22.0	6.2	70.6	0.9	24	7.6			
" "	" "	Aug. 13	**	25.0	5.7	67.5	4.5	9	7.4			
" "	" "	" 14	**	24.5	6.1	72.4	2.0	24	7.4			
Crab Creek Bridge on Federal Ave. Youngstown, Ohio	BMaC 39.2	July 2	35	15.5	5.4	54.0	28.6	46,000	7.4	12	124	168
" "	" "	" 16	10	18.5	0.0	00.0	33.2	46,000	7.3	32		164
" "	" "	" 23	8	22.0	0.0	00.0	48.3	460,000	7.2	29		166
" "	" "	" 31	8	22.5	0.0	00.0	22.8	93,000	7.3	26		240
" "	" "	Aug. 6	9	23.0	0.0	00.0	24.7	93,000	7.2	23		222
" "	" "	" 9	6	22.0	0.0	00.0	28.0	240,000	7.3	21		204
" "	" "	" 13	4	24.0	0.0	00.0	57.4	240,000	7.2	35		208
" "	" "	" 14	4	23.5	0.0	00.0	38.2	240,000	7.2	23		176
Crab Creek Poland Ave. Youngstown, Ohio	BMaC 38.5	June 25	1	21.5	5.1	57.0	12.4	36	9.6	42	690	680
" "	" "	July 3	2	15.0	8.0	78.6	12.3	240	9.0	8	213	244
" "	" "	" 16	2	18.5	7.1	75.0	11.2	24,000	9.0	17		310
" "	" "	" 23	2	21.5	1.1	12.9	32.1	2	10.1	...		580

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage from Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Gibson Run Poland Ave. Youngstown, Ohio	BMaG 38.5	July 31	2	21.5	0.4	4.0	39.1	150,000	8.4	25		300
" "	" "	Aug. 6	2	22.0	6.0	68.2	19.8	2,400	9.7	21		202
" "	" "	" 9	1	20.0	7.2	78.6	6.2	910	9.3	12		330
" "	" "	" 13	1	22.5	6.0	68.1	12.7	24,000	9.0	21		288
" "	" "	" 14	1	22.0	5.5	61.9	21.3	15,000	9.1	18		252
Mahoning River Center St. Bridge Youngstown, Ohio	BMa 37.0	June 25	440	25.0	2.4	28.6	5.8	2,400	7.1		54	
" "	" "	July 3	1,010	18.0	5.2	54.2	3.9	750	7.2			
" "	" "	" 16	298	25.0	0.0	00.0	8.9	15,000	6.7			
" "	" "	" 23	184	32.5	0.0	00.0	12.7	930	8.8			
" "	" "	" 31	104	35.0	0.5	7.1	9.0	7,500	6.9			
" "	" "	Aug. 7	120	30.5	0.0	00.0	10.2	24,000	6.8			
" "	" "	" 9	119	30.0	7.2	94.5	10.9	15,000	7.0			
" "	" "	" 13	125	32.0	0.0	00.0	15.5	24,000	6.6			
" "	" "	" 14	123	34.0	0.0	00.0	8.6	4,300	6.6			
Mahoning River Youngstown Sheet&Tube Br. Youngstown, Ohio	BMa 36.0	June 25	450	26.5	2.6	32.2	5.2	430	7.1		39	
" "	" "	July 3	1,050	19.0	5.2	55.1	5.3	1,200	7.0			
" "	" "	" 16	287	26.0	0.0	00.0	16.6	4,300	6.4	46		146
" "	" "	" 23	210	32.5	0.0	00.0	15.1	9,300	6.6			
" "	" "	" 31	161	34.5	0.0	00.0	16.0	9,300	6.5			
" "	" "	Aug. 7	135	32.5	0.0	00.0	8.8	15,000	6.3			
" "	" "	" 9	139	29.5	0.0	00.0	10.5	4,300	6.4			
" "	" "	" 13	134	32.5	0.0	00.0	16.4	4,300	6.4			
" "	" "	" 14	130	33.0	0.0	00.0	10.8	930	6.1			
Mahoning River Bridge in Lowellville, Ohio	BMa 31.5	June 25	475	25.5	4.0	47.8	1.2	43	5.5		14	
" "	" "	July 3	1,090	21.5	5.3	59.3	5.4	460	7.0			
" "	" "	" 17	208	29.0	3.1	39.6	5.0	930	7.6			
" "	" "	" 23	262	30.0	3.8	49.1	3.2	43	6.6			
" "	" "	" 31	209	31.0	0.0	00.0	5.3	4	6.0			
" "	" "	Aug. 7	134	29.0	0.5	6.9	3.7	43	6.4			
" "	" "	" 9	145	30.5	0.0	00.0	0.6	**	6.1			
" "	" "	" 13	140	31.5	0.0	00.0	5.6	4	7.2			
" "	" "	" 14	140	31.5	0.9	11.4	0.8 1.3*	2	5.5			
Mahoning River Bridge on U.S. 224 Kilbuck, Pa.	BMa 26.5	June 25	490	24.5	4.2	49.7	1.8	93	6.6		29	
" "	" "	July 3	1,130	21.0	5.3	58.5	4.8	240	6.8			
" "	" "	" 17	216	22.0	3.1	34.9	1.8	36	7.6			
" "	" "	" 23	273	28.0	3.3	42.0	2.1	4	6.8			
" "	" "	" 31	223	28.5	2.4	30.7	1.9	4	6.2			
" "	" "	Aug. 7	154	26.0	1.9	22.9	3.2	150	6.9			
" "	" "	" 9	152	26.5	3.0	36.6	3.3	2	7.0			
" "	" "	" 13	155	28.5	3.2	40.9	1.8	9	6.9			
" "	" "	" 14	155	28.0	2.6	32.7	2.0	46	6.6	8		

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c. f. s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Mahoning River 1 mile above mouth	BMa 21.5	July 5	83	19.3	5.2	55.8	4.3	93	7.4	25	55	112
" "	" "	" 17	263	25.0	4.1	43.0	0.7	4	7.5	27		156
" "	" "	" 23	289	27.5	4.2	52.1	3.9	1	7.4	5		144
" "	" "	Aug. 7	220	23.9	3.7	43.1	1.6	24	7.2			210
Mahoning River Bridge on Pa. 108 Mahoningtown, Pa.	BMa 22.5	June 25	538	23.5	3.8	44.0	2.6	23	6.9	27	40	244
" "	" "	July 3	1,260	22.0	5.1	58.2	5.9	460	6.8	47		124
" "	" "	" 19	306	27.5	4.1	51.2	1.3	4	7.4	7		170
" "	" "	" 31	240	28.0	3.1	38.9	2.6	9	7.3	5		212
" "	" "	Aug. 7	216	24.0	2.9	34.2	2.3	9	7.3			
" "	" "	" 9	211	25.5	3.2	38.7	1.8	2	7.1	5		252
" "	" "	" 13	196	26.5	4.2	51.4	1.9	2	7.0	15		240
" "	" "	" 14	140	27.5	3.6	45.4	2.1	8	7.3			256
Mahoning River-Br. on Pa 108-Mahoningtown, Pa.	BMa 22.5	Oct. 4		21.0	4.4	48.4	2.6	2	6.7	3	38	
" "	" "	" 16		11.5	5.1	46.2	2.8	11	6.7	23	62	
" "	" "	" 30		16.5	5.6	57.2	3.5	46	6.9	33	54	
" "	" "	Nov. 15	395	12.0	5.6	51.9	1.6	2	6.7	9	45	
" "	" "	" 28	925	13.0	7.5	70.5	3.7	46	6.7	12	53	
" "	" "	Dec. 10	1,025	10.5	8.0	71.6	5.0	460	6.4	23	50	
" "	" "	" 20	1,505	10.0	8.4	73.8	6.7	230	6.3	85	20	
" "	" "	Jan. 3	2,910	7.0	10.2	84.1	5.1	930	6.5	85	29	
Shenango River Br. at Riverside Hotel Greenville, Pa.	BSh 69	July 4	75	17.0	8.3	85.6	1.6	23	7.4		66	
" "	" "	" 13	145	21.0	7.9	87.8	2.4	110	7.4			
" "	" "	" 24	126	25.0	7.5	89.0	3.9	23	7.4			
" "	" "	Aug. 1	130	20.5	7.2	79.1	6.1	43	7.2			
" "	" "	" 8	134	20.5	7.2	79.6	3.8	4	7.3			
Shenango River 3 miles below Greenville, Pa.	BSh 65.5	July 4	91	18.0	7.0	73.3	2.3	73	7.4		66	
" "	" "	" 18	149	21.5	6.8	76.3	3.8	240	7.1			
" "	" "	" 24	138	26.0	6.6	80.5	3.1	240	7.2			
" "	" "	Aug. 1	153	21.0	6.1	68.1	6.3	460	7.2			
" "	" "	" 8	135	20.0	6.4	70.7	5.1	390	7.3			
Shenango River Mercer Pk. Bridge Sharpsville, Pa.	BSh 52.0	July 4	293	21.0	9.2	102.0	1.8	15	7.5		58	
" "	" "	" 18	313	23.5	6.7	77.9	2.2	1,100	7.2			
" "	" "	" 24	133	25.5	7.3	87.5	3.0	23	7.4			
" "	" "	Aug. 1	197	22.0	8.1	92.2	7.5	4	7.5			
" "	" "	" 8	143	20.0	7.8	84.8	2.5	24	7.3			
Shenango River Clark St. Bridge Sharpsville, Pa.	BSh 50.3	July 4	325	20.5	8.8	97.2	2.0	23	7.5		57	
" "	" "	" 18	352	24.0	6.4	74.4	2.7	23	7.3			
" "	" "	" 24	186	26.0	6.1	74.8	2.0	23	7.4			
" "	" "	Aug. 1	200	22.0	6.4	73.0	6.0	24	7.4			
" "	" "	" 8	148	20.5	6.8	75.2	3.6	15	7.4			
Little Yankee Creek 1½ miles above Hubbard, Ohio	BShL 50	June 27	19	20.0	8.7	94.7	2.1	4	7.4		51	
" "	" "	July 11	8	20.5	6.7	73.9	1.5	4	7.4			
" "	" "	Aug. 5	2	23.0	5.6	64.7	1.7	4	7.3			

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml.	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Little Yankee Creek 1 mile below Salem, Ohio	BShL 47.0	June 27	30	19.0	9.7	104.0	1.0	36	7.4	5	55	78
" "	" "	July 11	6	20.5	7.2	79.4	1.1	43	7.4	30		78
" "	" "	Aug. 5	3	23.5	5.9	68.5	1.7	150	7.3	12		90
Yankee Run at Salem on U.S. 62	BShY 44.5	July 4	28	19.0	9.3	99.0	1.4	2	7.3	7	48	72
" "	" "	" 18	8	23.5	7.2	84.1	1.6	24	7.2	20		74
" "	" "	" 24	7	25.0	4.4	52.9	1.7	460	7.1	38		88
" "	" "	Aug. 1	1	21.0	5.6	62.1	2.4	93	7.1	32		84
" "	" "	" 8	**	21.5	5.0	55.6	2.3	240	7.2	13		92
Shenango River 4 miles below Sharon, Pa.	BSh 42	July 4	417	19.5	6.8	73.3	2.9	150	7.3	15	59	84
" "	" "	" 18	376	25.0	6.0	71.7	2.7	240	7.1	31		74
" "	" "	" 24	190	28.0	2.8	34.8	4.5	1,500	7.0	23		62
" "	" "	Aug. 1	202	24.0	3.2	37.6	10.1	4,600	7.0	30		74
" "	" "	" 8	154	22.0	3.2	36.5	4.9	2,400	6.9	25		84
Shenango River 3 miles above New Castle, Pa.	BSh 27.5	July 5	401	16.0	6.2	62.5	1.3		7.2		54	
" "	" "	" 19	367	24.0	5.4	63.2	2.7	93	7.3			
" "	" "	" 25	236	26.0	5.8	71.0	6.0	43	7.4			
" "	" "	Aug. 2	215	22.5	5.4	61.5	12.7	23	7.1			
" "	" "	" 7	267	22.0	7.1	80.5	11.0	93	7.3	20		112
" "	" "	" 12	159	25.5	5.3	63.7	7.6	240	7.1			
Neshannock Creek Bridge Rt. 58 Harrar, Pa.	BShN 47.5	July 4	45	17.5	8.4	87.2	1.9	2	7.3		68	
" "	" "	" 18	39	20.0	6.8	74.2	1.6	24	7.2			
" "	" "	" 24	29	24.5	6.6	77.6	1.7	240	7.4			
" "	" "	Aug. 1	4	20.3	7.1	77.7	7.6	460	7.2			
" "	" "	" 8	11	21.0	7.5	83.8	2.4	240	7.4			
Neshannock Creek 1 mile below Harrar, Pa.	BShN 46.5	July 4	52	18.0	8.2	85.7	1.6	240	7.4	5	65	104
" "	" "	" 18	43	20.0	5.6	61.1	1.4	930	7.2	18		104
" "	" "	July 24	35	25.0	4.1	49.3	1.9	430	7.0			
" "	" "	Aug. 1	12	20.0	5.0	54.1	2.6	430	7.2			
" "	" "	" 8	12	20.5	5.1	56.1	2.0	230	7.2			
Neshannock Creek, Village of New Wilmington, Pa.	BShN 38.5	July 5	149	15.5	8.4	83.3	1.8	4	7.5	4	71	110
" "	" "	" 19	85	23.0	8.2	94.8	3.2	2	7.5	8		114
" "	" "	" 24	60	29.0	8.7	112.2	2.6	24	7.9	7		168
" "	" "	" 19	85	23.0	8.2	94.8	3.2	2	7.5	8		114
" "	" "	Aug. 1	43	22.3	9.4	107.9	2.3	43	8.3	3		192
" "	" "	" 8	25	23.0	9.4	108.5	2.3	2	7.8	4		174
" "	" "	Oct. 4		13.0	10.5	98.8	1.3	**	6.7	5	54	
" "	" "	" 16		7.0	10.9	89.7	1.1	2	6.5	3	105	
" "	" "	" 30		10.0	10.5	92.5	0.9	11	7.0	6	102	
" "	" "	Nov. 15	95	3.5	12.3	92.5	0.8	46	6.8	3	63	
" "	" "	" 28	260	3.5	13.8	103.8	2.6	240	6.6	10	47	
" "	" "	Dec. 10	278	3.5	13.4	100.5	0.7	43	6.1	6	54	

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Beshannock Creek-Mouth New Castle, Pa.	BShM 24.5	Dec. 20	396	3.5	13.0	98.0	0.5	93	6.5	22	29	
" "	" "	1941 Jan. 3	715	3.5	12.6	94.5	0.7	230	6.6	12	29	
Neshannock River Cherry St. Bridge New Castle, Pa.	BR 23.0	July 17	258	19.5	8.7	93.5	4.0	150	7.9			
" "	" "	Oct. 4		16.0	9.4	94.7	2.6	240	6.5	8	50	
" "	" "	" 16		10.5	8.9	79.6	2.3	43	6.8	9	52	
" "	" "	" 30		12.0	8.8	81.0	2.6	93	6.9	17	53	
" "	" "	Nov. 15	274	5.0	11.1	86.4	1.9	460	6.9	8	56	
" "	" "	" 28	615	4.0	12.1	91.9	4.1	240	6.8	23	50	
" "	" "	Dec. 10	760	3.5	12.9	96.7	1.6	93	6.3	22	31	
" "	" "	" 20	1,035	3.5	12.5	93.8	1.2	93	6.6	7	31	
" "	" "	1941 Jan. 3	1,990	4.0	12.1	92.3	1.3	91	6.7	22	29	
Cascade Run New Castle, Pa.	Bsh 21.5	July 1940 5	422	16.0	7.5	75.7	2.2	4	7.4	9	57	78
" "	" "	" 19	433	24.0	6.8	79.8	4.8	93	7.4	27		88
" "	" "	" 25	297	23.5	5.9	69.0	5.2	23	7.4	16		102
" "	" "	Aug. 2	258	20.0	6.7	73.3	14.1	93	7.2	21		114
" "	" "	" 12	195	23.5	7.0	81.2	5.6	75	7.2	20		94
Beaver River 2 mi. bel. Hamilton Bridge New Castle, Pa.	B 15.5	July 5	649	25.5	4.5	54.1	3.9	150	7.5	17	72	128
" "	" "	" 17	672	22.0	3.9	44.0	5.4	930	7.5			
" "	" "	" 25	425	26.0	2.3	27.5	9.4	230	7.2			
" "	" "	Aug. 2	396	22.0	3.5	39.2	17.2	150	7.1			
" "	" "	" 7	492	24.0	2.8	33.4	8.0	930	7.1			
" "	" "	" 12	380	24.5	3.7	43.7	9.2	230	7.0			
" "	" "	Oct. 4		17.5	5.3	54.6	4.5	460	6.7	8	45	
" "	" "	" 16		10.5	5.5	49.1	3.2	240	6.9	9	64	
" "	" "	" 30		13.5	5.5	52.5	5.4	230	6.8	19	57	
" "	" "	Nov. 15	772	5.0	8.1	63.5	2.1	1,100	6.7	6	52	
" "	" "	" 28	1,820	8.0	9.8	82.4	4.2	4,600	6.9	25	51	
" "	" "	Dec. 10	2,158	6.5	10.6	85.8	3.4	230	6.6	23	37	
" "	" "	" 20	3,080	6.0	10.1	80.8	3.3	230	6.4	55	23	
" "	" "	Jan. 3	5,925	5.0	11.3	88.0	3.7	430	6.7	55	32	
Br. Slippery Rock Creek Slippery Rock, Pa.	BCoSl 42	July 5	38	17.5	8.8	91.0	1.2	6	7.4	15	56	86
" "	" "	" 19	39	24.0	2.6	30.1	1.0	4	7.4			
" "	" "	" 26		26.5	6.6	81.1	0.8	4	7.4	10		166
Slippery Rock Creek 1 mile south of Slippery Rock, Pa.	BCoSl 42	July 19		24.5	7.9	93.3	0.8	1	7.5	20		124
Wolf Creek Br. upper edge of Grove City, Pa.	BCoSlW 47.5	July 5	24	18.5	8.2	86.6	1.4	24	7.3		51	
" "	" "	" 19	11	24.5	5.7	67.9	2.3	8	7.1			
" "	" "	" 26	6	26.0	6.2	75.9	1.8	4	7.0			
Wolf Creek 2 miles bel. Grove City, Pa.	BCoSlW 45.5	July 5	31	17.5	8.9	92.5	2.0	9	7.4	13	56	82
" "	" "	" 19	11	22.0	9.3	105.0	2.0	2	7.6	14		108
" "	" "	" 26	7	22.0	7.5	84.5	1.7	23	7.4	10		114

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Slippery Rock Creek Above Ellwood City, Pa.	BCoS1 17.5	June 24	318	22.0	9.1	102.8	0.9	4	7.5	14	57	94
" "	" "	July 9	142	23.5	9.3	108.6	2.0	91	7.6	17		96
" "	" "	" 26	66	20.0	7.8	102.8	1.4	2	7.6	10		128
Connoquenessing Creek Bridge U.S. 422 Butler, Pa.	BCo 57.5	June 24	10	20.5	7.3	80.2	1.1	23	6.5		30	
" "	" "	July 9	6	20.0	6.9	75.0	0.7	4	6.6			
" "	" "	" 26	15	29.0	3.2	40.9	1.5	7	6.8			
Connoquenessing Creek 2 miles below Butler, Pa.	BCo 54.0	June 24	35	22.0	6.5	73.2	12.4	36	6.4		25	
" "	" "	July 9	22	22.0	5.7	64.2	10.7	23	6.6			
" "	" "	" 26	18	30.0	1.5	19.9	1.5	4	6.2			
Connoquenessing Creek Bridge Pa. 328 Renfrew, Pa.	BCo 49.0	June 24	62	21.5	6.8	76.5	3.0	91	6.6		34	
" "	" "	July 9	39	22.0	6.3	71.2	4.6	93	6.7			
" "	" "	" 26	21	29.0	6.8	87.3	2.5	23	6.9			
Breakneck Creek ½ mile above Mars, Pa.	BCoB 46	July 8	4	21.5	10.1	113.5	1.2	46	7.6		56	
" "	" "	" 25	8	23.5	4.8	55.7	5.2	4,600	7.2			
" "	" "	Aug. 2	••	20.0	1.2	12.9	6.0	11,000	7.2			
" "	" "	" 12	••	23.0	4.3	49.1	4.9	430	7.4			
Breakneck Creek 1½ miles below Mars, Pa.	BCoB 44.5	July 8	8	21.0	9.5	105.6	2.5	1,100	7.5		63	
" "	" "	" 25	3	22.5	7.6	87.2	2.4	930	7.5			
" "	" "	Aug. 2	1	19.5	7.8	84.0	2.5	230	7.3			
" "	" "	" 12	••	22.5	7.2	82.7	2.0	24,000	7.4			
Breakneck Creek at corner of Evans City, Pa.	BCoB 41	July 8	24	23.0	10.6	122.6	1.9	110	7.8		64	
" "	" "	" 25	5	25.5	6.1	73.5	3.1	43	7.4			
" "	" "	Aug. 2	1	21.0	6.0	67.3	3.7	7	7.4			
" "	" "	" 12	••	22.5	6.1	69.7	7.4	240	7.6			
Breakneck Creek 1 mile below Evans City, Pa.	BCoB 39.0	July 8	31	23.0	7.2	83.1	7.1	2,400	7.5	12	71	90
" "	" "	" 25	6	26.5	6.7	82.1	6.5	4,300	7.4	28		112
" "	" "	Aug. 2	1	20.5	4.5	49.2	15.0	4,300	7.1	33		124
" "	" "	" 12	••	23.0	0.0	00.0	19.0	36	7.1	33		140
Connoquenessing Creek U.S. Route 19 Harmony, Pa.	BCo 36.0	June 24	131	21.5	8.2	91.9	1.9	4	7.2		38	
" "	" "	July 9	82	23.0	8.7	100.7	1.6	1	6.9			
" "	" "	" 26	32	29.0	6.9	89.1	3.5	4	7.2			
Connoquenessing Creek 2 miles below Zelienople, Pa.	BCo 31.5	June 24	149	21.5	7.7	86.5	1.8	23	7.2		37	
" "	" "	July 9	93	21.5	8.0	89.9	1.3	21	7.2			
" "	" "	" 26	33	29.5	7.3	94.9	3.4	93	7.4			
Connoquenessing Creek 14 miles above Ellwood City, Pa.	BCo 17.0	June 24	210	23.0	9.1	105.1	1.8	4	7.3	16	37	112
" "	" "	July 9	123	25.5	8.9	107.1	2.0	4	7.3	20		112
" "	" "	" 26	52	29.0	8.3	107.3	4.0	24	7.5	30		120

TABLE B-7 BEAVER RIVER BASIN

OHIO RIVER POLLUTION SURVEY
LABORATORY DATA

SUMMARY OF INDIVIDUAL RESULTS

Sampling Point	Mileage From Mouth	Date 1940	Average Discharge c.f.s.	Temp. °C	Dissolved Oxygen p.p.m.	Dissolved Oxygen % Sat.	5 Day B.O.D. p.p.m.	Coliform M.P.N. Per ml	pH	Turbidity p.p.m.	Alkalinity p.p.m.	Hardness p.p.m.
Beaver River Beaver Bridge Beaver Falls, Ohio	B 5.5	July 8	1,050	25.5	9.0	108.7	4.4	9	7.6		61	
" "	" "	" 17	880	22.0	7.4	83.9	3.9	9	7.3	18		150
" "	" "	" 25	690	25.0	5.9	70.9	2.5	9	7.2	13		154
" "	" "	Aug. 2	640	23.0	5.1	58.6	3.8	24	7.2	15		140
" "	" "	" 7	690	23.0	6.1	69.8	3.2	4	7.1	7		170
" "	" "	" 12	570	24.0	7.3	86.0	6.1	4	7.3	16		162
Beaver River At Mouth	B 1.4	Oct. 2	620	18.0	8.4	88.3	2.1	1,100	6.5	11	34	
" "	" "	" 4	575	17.0	8.4	86.2	1.6	430	6.2	12	24	
" "	" "	" 8	640	18.0	8.5	89.0	2.6	930	6.1	9	24	
" "	" "	" 10	640	17.0	8.5	86.9	2.4	460	6.0	10	14	
" "	" "	" 14	640	17.0	8.5	87.7	3.8	150	6.2	8	47	
" "	" "	Oct. 16	620	16.5	6.4	64.7	2.8	460	6.2	12	45	
" "	" "	" 18	640	15.0	7.8	77.0	1.9	930	6.2	12	27	
" "	" "	" 22	660	12.0	8.7	80.1	3.0	930	6.0	13	27	
" "	" "	" 24	640	12.0	9.0	83.3	2.2	2,400	6.3	11	21	
" "	" "	Oct. 28	575	12.0	9.2	84.9	3.9	230	6.4	12	58	
" "	" "	" 30	710	13.0	7.9	74.6	1.9		6.4	37	42	
" "	" "	Nov. 1	910	12.5	9.4	87.9	2.8	240	6.4	12	50	
" "	" "	" 5	1,320	12.5	9.8	91.8	2.4	43	6.5	22	48	
" "	" "	" 7	1,150	10.0	10.2	90.3	1.1	24	6.5	42	43	
" "	" "	" 13	2,130	9.0	11.0	94.5	1.8	110	6.8	24	47	
" "	" "	" 15	1,690	8.0	11.2	94.5	1.3	43	6.6	16	35	
" "	" "	" 19	1,150	5.0	12.2	95.3	1.8	150	6.6	20	37	
" "	" "	" 25	1,340	9.0	10.7	92.5	1.3	75	6.6	25	36	
" "	" "	" 27	2,650	7.0	11.2	92.3	1.6	460	6.6	30	35	
" "	" "	" 29	3,830	5.0	12.9	100.9	1.9	91	6.2	35	34	
" "	" "	Dec. 3	4,000	2.0	13.2	95.4	2.1	460	7.0	50	35	
" "	" "	" 5	2,340	2.0	13.4	97.1	2.8	93	6.5	23	28	
" "	" "	" 9	4,700	4.0	13.2	100.7	2.5	150	6.8	30	30	
" "	" "	" 11	3,050	5.0	12.2	95.4	2.0	240	6.3	23	28	
" "	" "	" 13	6,200	6.5	12.0	97.5	2.3	93	6.4	20	30	
" "	" "	Dec. 17	10,200	6.0	12.2	97.5	3.7	1,100	7.0	110	28	
" "	" "	" 19	5,930	4.0	12.9	98.1	2.1	430	6.8	50	26	
" "	" "	" 23	3,630	5.5	12.5	98.7	1.6	150	6.3	22	31	
" "	" "	" 27	2,730	7.0	11.8	97.3	1.0	1,100	7.0	23	33	
" "	" "	" 31	19,500	5.0	11.6	90.5	6.4	150	6.8	170	33	
" "	" "	1941 Jan. 2	15,800	5.5	12.6	99.4	3.3	210	6.6	70	28	

* Seeded and Neutralized

** Less than one